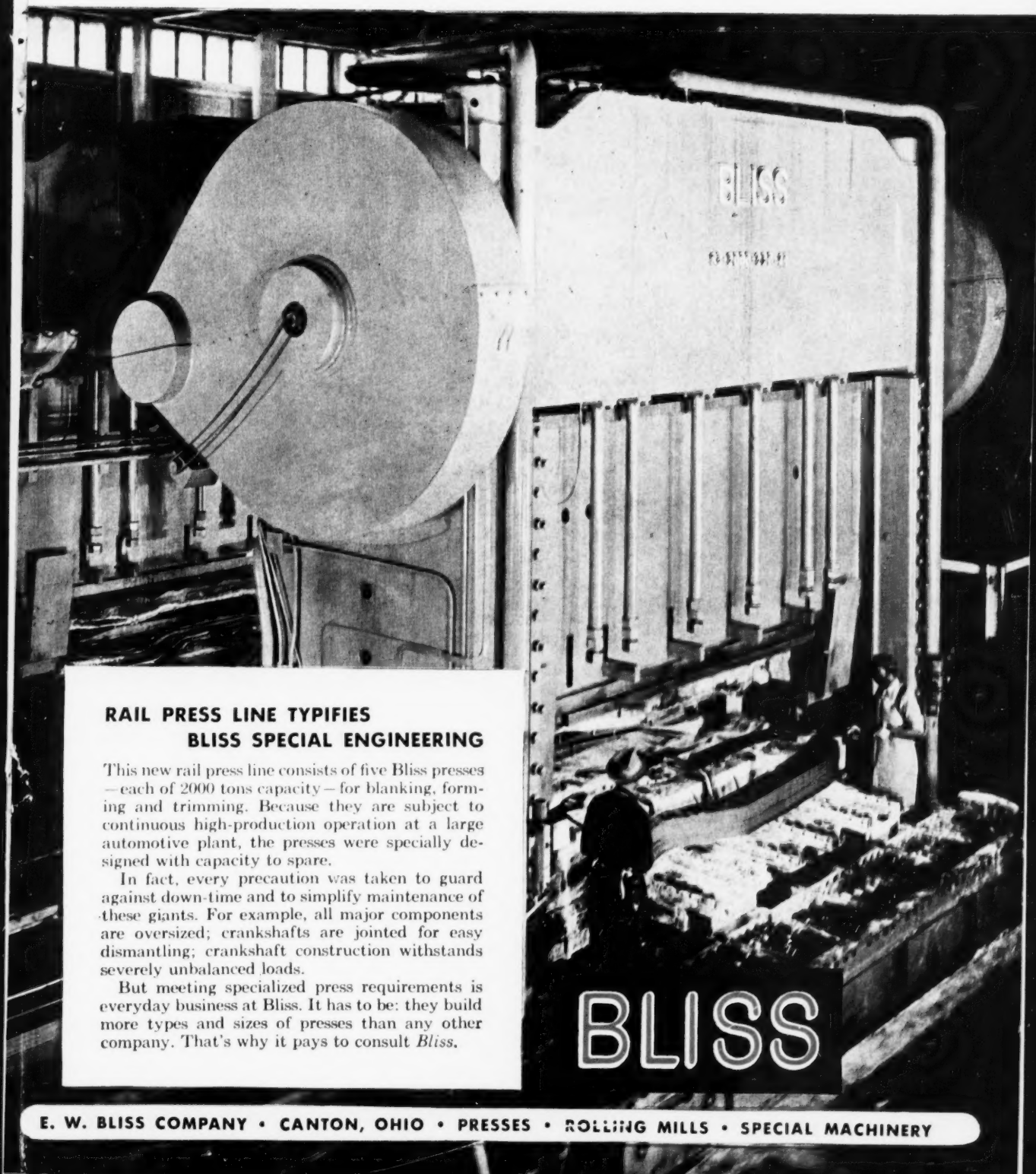
FEBRUARY 1954—SIXTIETH YEAR

MACHINERY



RAIL PRESS LINE TYPIFIES BLISS SPECIAL ENGINEERING

This new rail press line consists of five Bliss presses—each of 2000 tons capacity—for blanking, forming and trimming. Because they are subject to continuous high-production operation at a large automotive plant, the presses were specially designed with capacity to spare.

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But meeting specialized press requirements is everyday business at Bliss. It has to be: they build more types and sizes of presses than any other company. That's why it pays to consult *Bliss*.

BLISS

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That's what most GREENFIELD Distributors can boast when you ask about threading tools and gages. In fact, chances are that a GREENFIELD Distributor is *The Cutting Tool Center* in your trading area. His knowledge of local demand and of suppliers, his stocks on hand, his ability to give service, all are yours when you buy through a distributor.

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15937 W. Seven Mile Road
Detroit 35, Mich.

DON HARWAY & COMPANY
1709 W. Eighth St., Los Angeles 17, Calif.

MACHINERY, published monthly by The Industrial Press, Emmett St., Bristol, Conn. Executive offices 148 Lafayette St., New York 13, N. Y.

Subscription Rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1954 by The Industrial Press.

Entered as second-class mail matter May 25, 1953, at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Printed in the United States of America.

British Address
National House, West St.
Brighton 1, England

French Address
15, Rue Bleue
Paris-IX*, France

MACHINERY

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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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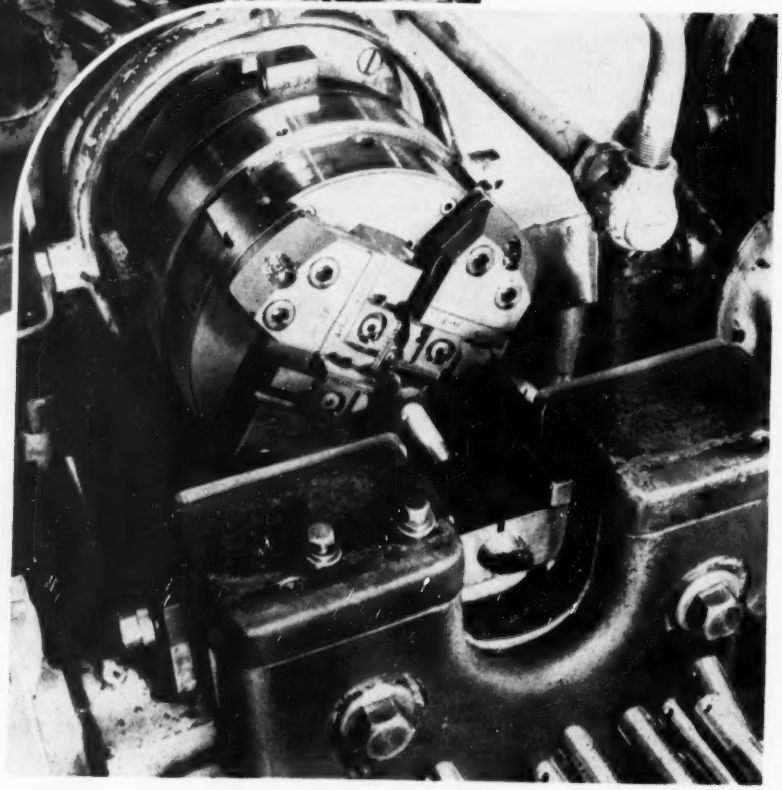
BOLTS threaded ON A



THE WORLD'S

to ±.001

LANDMACO MACHINE

Using LANDIS Threading Equipment, the Chicago Screw Company of Bellwood, Illinois, is able to thread connecting rod bolts to better than Class 4 fit at normal production rates and economical tool cost.

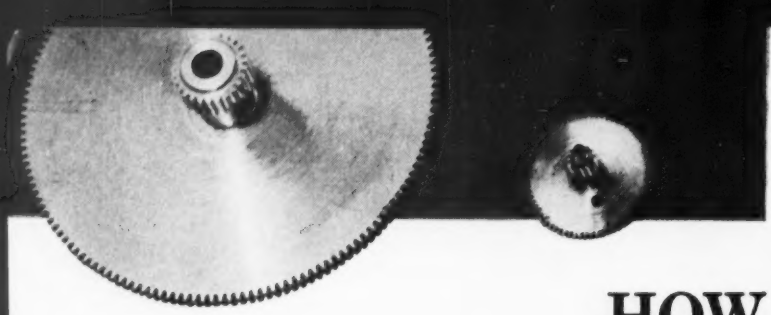
Bolt blanks are of 8640 steel of 30-36 Rockwell "C" hardness. 11/16" diameter 16 pitch UN form threads must be cut 1-7/16" long over a cotter key hole. Specifications required a ±.001" tolerance on the Pitch Diameter of the thread, and finished threads are closely inspected for concentricity.

To perform this operation a 1½ LANDMACO Double-Spindle Threading Machine equipped with Leadscrew, Hardened and Ground LANCO Heads, and Chasers of special throat length and hardness was installed. In normal production, this LANDMACO Machine regularly completes 127 threaded pieces per hour cutting at 15 surface feet per minute. On an average 400 threads per head are produced between each regrinding of the chasers.

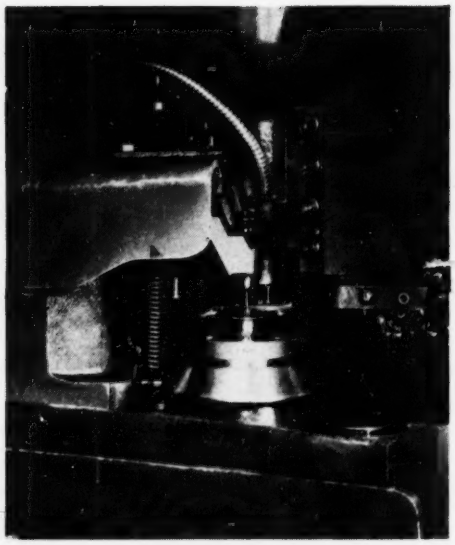
This installation illustrates the production advantages of LANDIS Equipment for difficult and exacting threading operations. The mechanically-controlled positive feed of the Leadscrew, the maximum rigidity of Die Heads designed for precision threading, and Chasers of special specifications—allow threading hard material with minimum cutting strain. As a result, threads are produced to close tolerances at economical production rates and low tool cost. For further information, ask for Bulletins H-75 (LANDMACO Machines) and F-80 (Hardened and Ground Heads). Please send specifications when writing.

LARGEST MANUFACTURERS OF THREAD GENERATING EQUIPMENT

• LANDIS *Machine* CO. WAYNESBORO PENNSYLVANIA •

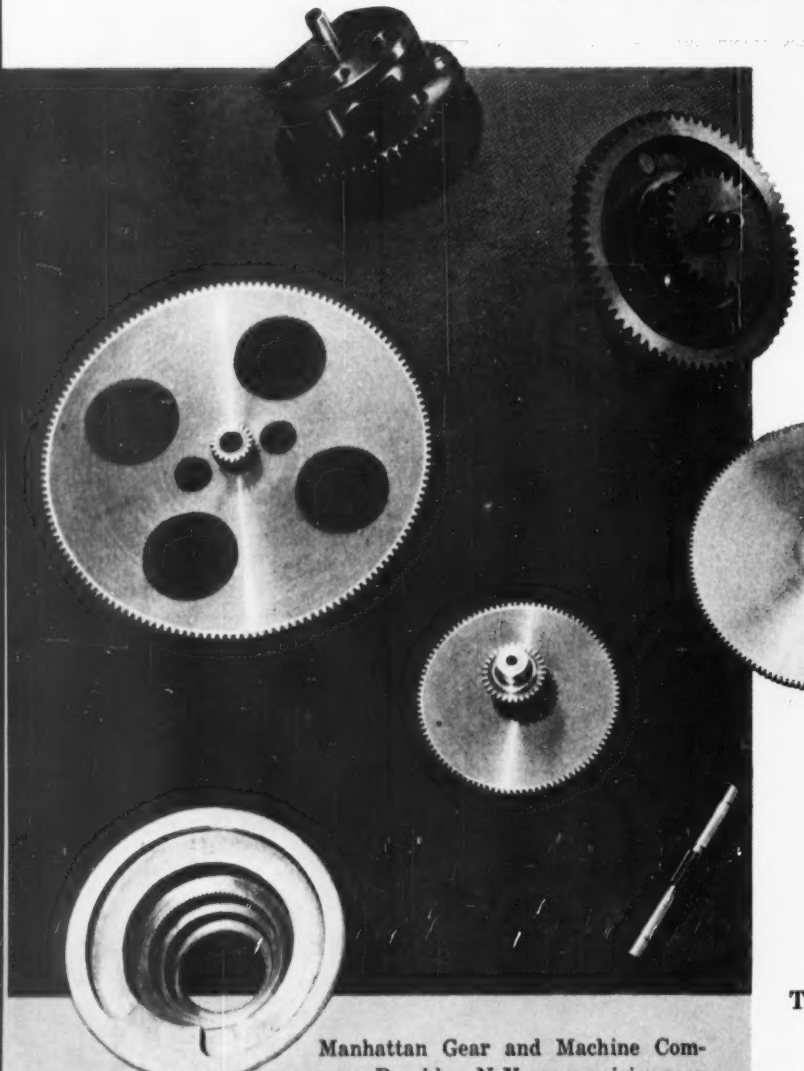


HOW 'MANHATTAN GEAR' MEETS SPECIFICATIONS ... EVEN TO .0003"



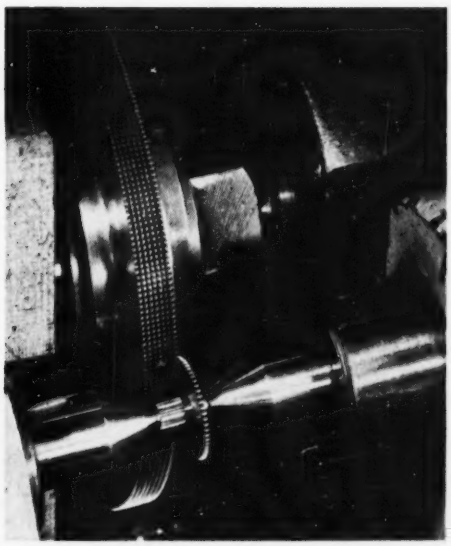
Fundamental Control

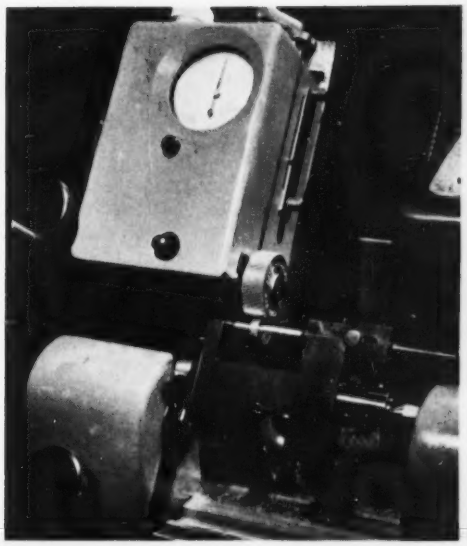
has always been the basic reason for a precision manufacturer's dependence on Fellows equipment. The generating principle coupled with the super-accuracy of Fellows cutters will more than meet the demand for accuracy *and* production speed in your shop. As shown here, the Fellows 3-Inch Fine-Pitch Gear Shaper is the first step in meeting the closest specifications.



Manhattan Gear and Machine Company, Brooklyn, N.Y. are *precision* gear specialists who put *precision* first. Quite naturally they get many 'real tough' gear production problems. Their record of customer satisfaction speaks well for Manhattan's men and machines.

THE *Fellows*





Close-Limit Tolerances

are further assured by finishing on a Fellows #4 Fine-Pitch Gear Shaving Machine, which provides the final touch to the smoothness and accuracy so vital to the exacting requirements for small precision gears running in combination.

Proof Positive

is now possible with the advent of the new Fellows #4 Fine-Pitch Red Liner. Chart-recorded inspections show composite errors, magnified up to 800 times, assures this manufacturer's fine quality control.

• *Write the nearest Fellows office for complete descriptive information on the Fine-Pitch team including the newest member, the Fellows #4 Fine-Pitch Red Liner.*

GEAR SHAPER COMPANY

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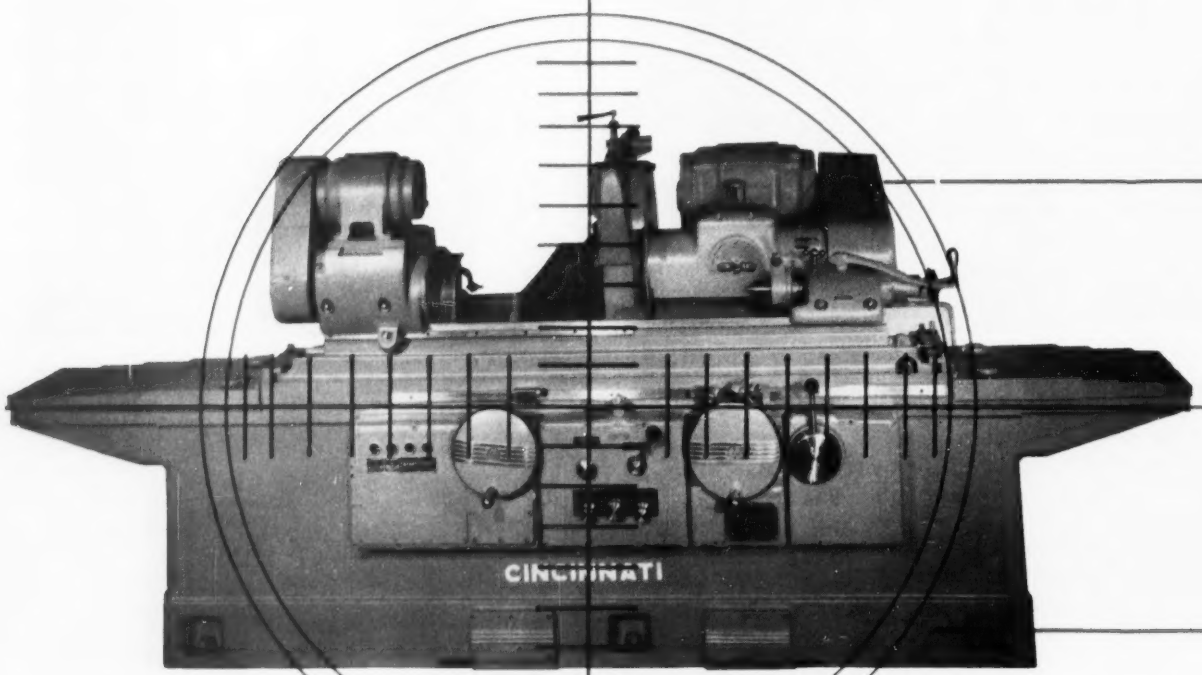
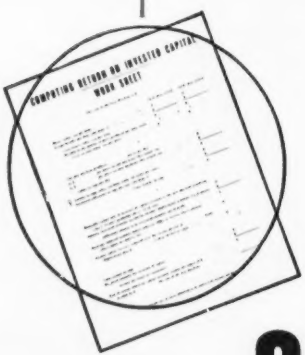
Any Way You

CINCINNATI FILMATIC PLAIN HYDRAULIC GRINDERS REDUCE



CINCINNATI FILMATIC 10" x 36"
Plain Hydraulic Grinding Machine



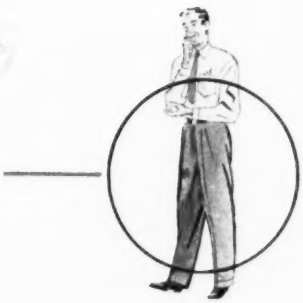
FILMATIC

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES

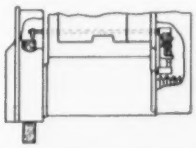
Look at it

COSTS IN YOUR SHOP

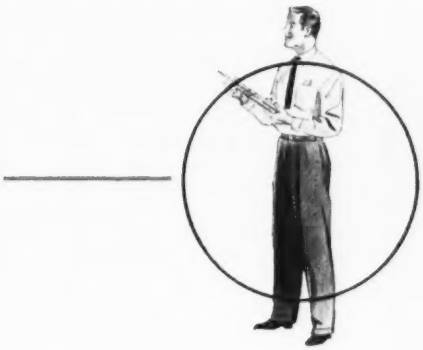


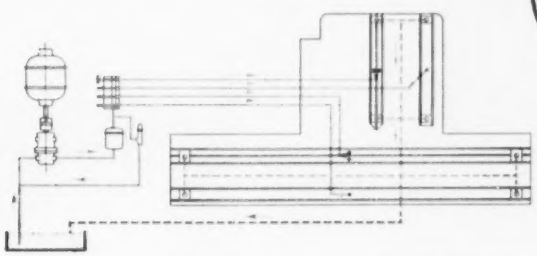
Look at the spindle bearings, the bed construction, lubrication of ways, electrical controls. Look at everything that effects efficient, low-cost production of precision centertype grinding, and you'll agree that CINCINNATI FILMATIC Plain Hydraulic Grinders have the potential to save a lot of money for your shop. A few ways in which the superior features of CINCINNATI FILMATICS keep costs at a minimum are illustrated here.

CINCINNATI'S exclusive FILMATIC bearings for the grinding wheel spindle require no adjustment; over 99% have never required service or maintenance.

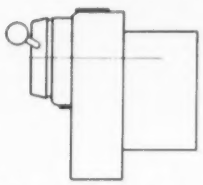


To minimize wheel cost, these machines are equipped with a two-speed device for the grinding wheel.

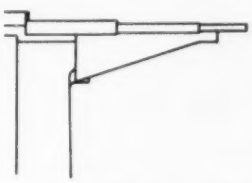




Automatic filtered lubrication of ways aids greatly in maintaining straight-line traverse and close accuracy for years.



Unit construction for principal hydraulic elements cuts maintenance expense.



Sliding covers protect the ways, reduce maintenance costs, increase life span.

Any way you look at it, CINCINNATI FILMATIC Plain Hydraulic Grinders are the best buy for variety or production centertype grinding operations. It will pay you to replace your old grinders *now* with new CINCINNATIS. Brief specifications will be found in Sweet's Machine Tool Catalog. You may obtain complete data by writing for literature: No. G-566-2 for the 6" and 10"-L sizes; No. G-603 for the 10" and 14"-L sizes.

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

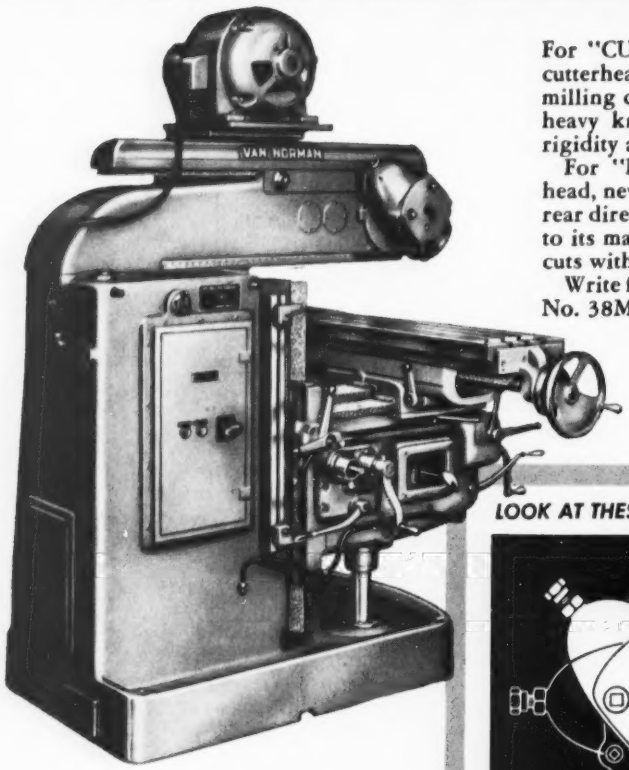
(Subsidiary of The Cincinnati Milling Machine Co.)

CINCINNATI 9, OHIO

CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

Announcing The VAN NORMAN No. 38M Miller

One of 10 New Ram Type Models Especially Designed to Give You Greater "Flex-ability" and "Cut-ability"



For "CUT-ABILITY", the 10 HP spindle motor drives the cutterhead only . . . provides ample power for every type of milling cut. The new box type column and base plus the new heavy knee, saddle and table assemblies assure maximum rigidity and accuracy.

For "FLEX-ABILITY", the new heavy adjustable cutterhead, new larger extended ram and heavy knee with front and rear directional power and manual feed controls. Ram extends to its maximum range of 29". New design permits maximum cuts within entire ram range.

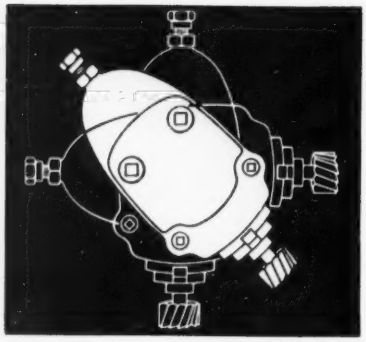
Write for complete details on the new, modern Van Norman No. 38M Ram Type Milling Machine.

No. 38 M

Table: 64" x 14"
Spindle Motor: 10 HP
Feed Motor: 1½ HP

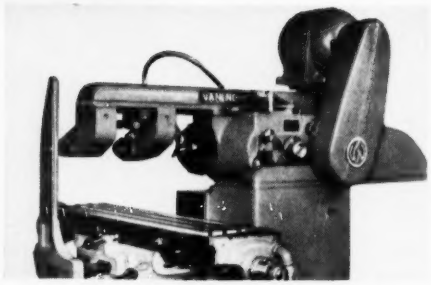
Interested in Extra Vertical and Table Range: See Your Van Norman Dealer

LOOK AT THESE "PLUS" FEATURES FOR MAXIMUM "FLEX-ABILITY"



Adjustable cutterhead permits horizontal, angular and vertical milling on one machine. Reduces work reset-ups, eliminates idle machine time.

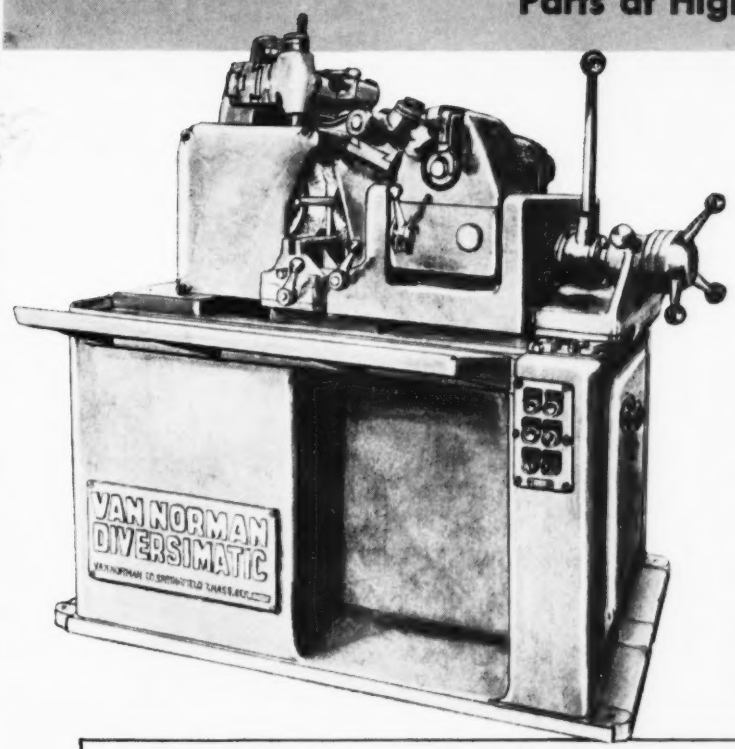
Machine shown with overarm, arbor supports, and outerbrace.



VAN NORMAN makers of—Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

New Van Norman *Diversimatic*® Centerless Grinder

Gives "Close-Tolerance" Grinding of Small Parts at High Production Rates



This new grinder provides fine finish to close tolerances at high production rates. It finish grinds parts from solid . . . or finish grinds rough-turned pieces. When equipped with a Crush Forming Attachment, it form grinds and does profile work.

These Diversimatic® Features Cut Grinding Costs!

- Heavy Duty grinding wheel is mounted on double-row super precision ball and roller bearings, sealed and lubricated for life, assuring trouble-free operation.
- Spindle requires no warm-up period.
- Grinding wheel and regulating wheel dressers hydraulically-operated.
- Infinitely variable ¼ h.p. regulating wheel drive, 15 to 800 r.p.m.

Get the full facts. See how this versatile grinder can cut your grinding costs on small shafts, formed shapes, parts of two or more diameters or special contours.

CENTERLESS GRIND PARTS LIKE THESE FASTER, MORE ECONOMICALLY ON THE DIVERSIMATIC

VAN NORMAN CO., Springfield 7, Mass.

More Centerless Output-

Exclusive Landis features

162

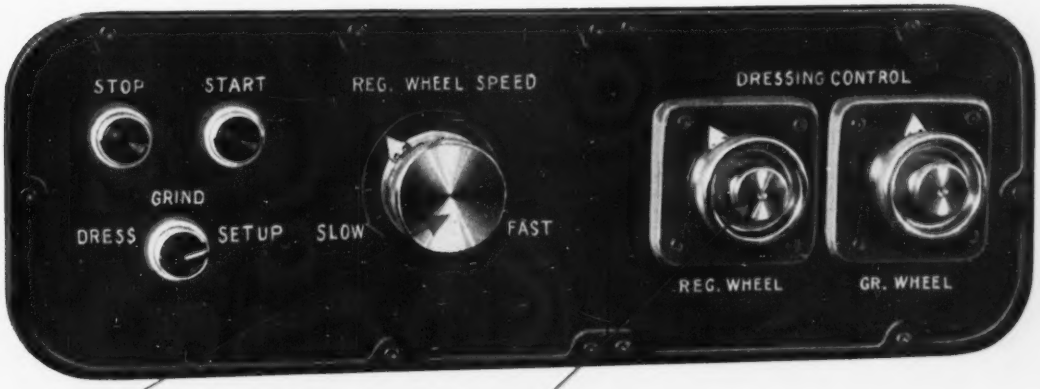
LANDIS

precision grinders

Modern Landis No. 12 Centerless Grinder. For complete information and specifications, write for Catalog T-47.

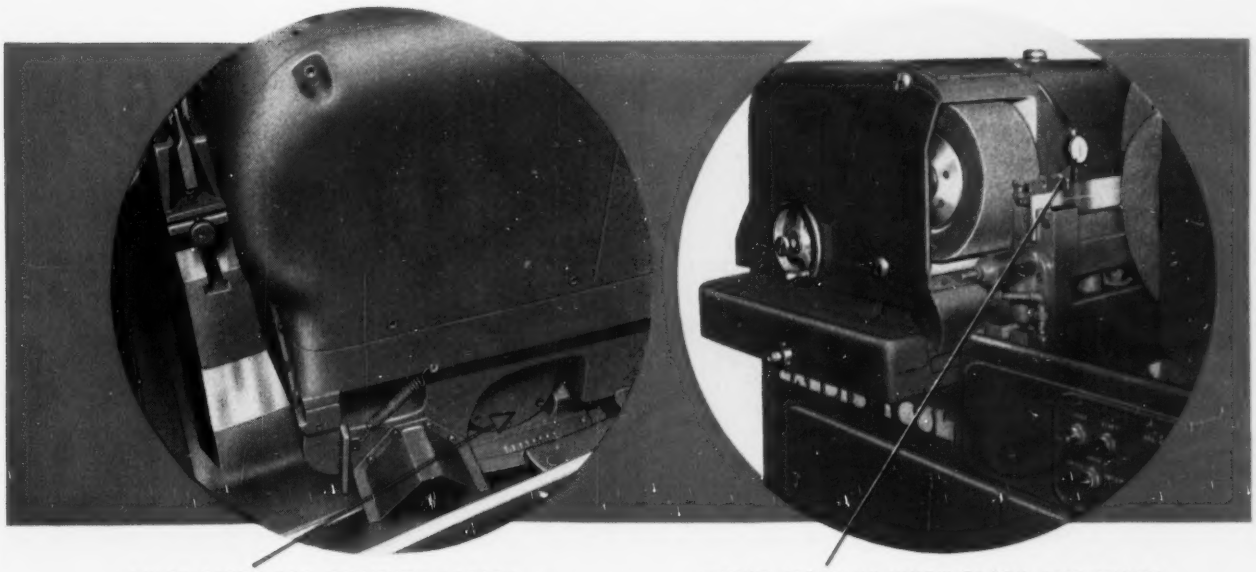
Less Setup Time

cut costs on short production runs



SIMPLE REGULATING WHEEL SPEED ADJUSTMENT Convenient rheostat control can vary regulating wheel speed from 12 to 100 r.p.m. Any speed, within range, quickly and easily selected.

FAST CHANGE TO DRESSING SPEED —Preset higher speed for dressing regulating wheel obtained by turning selector switch. No readjustment of normal regulating wheel speed is required after dressing.



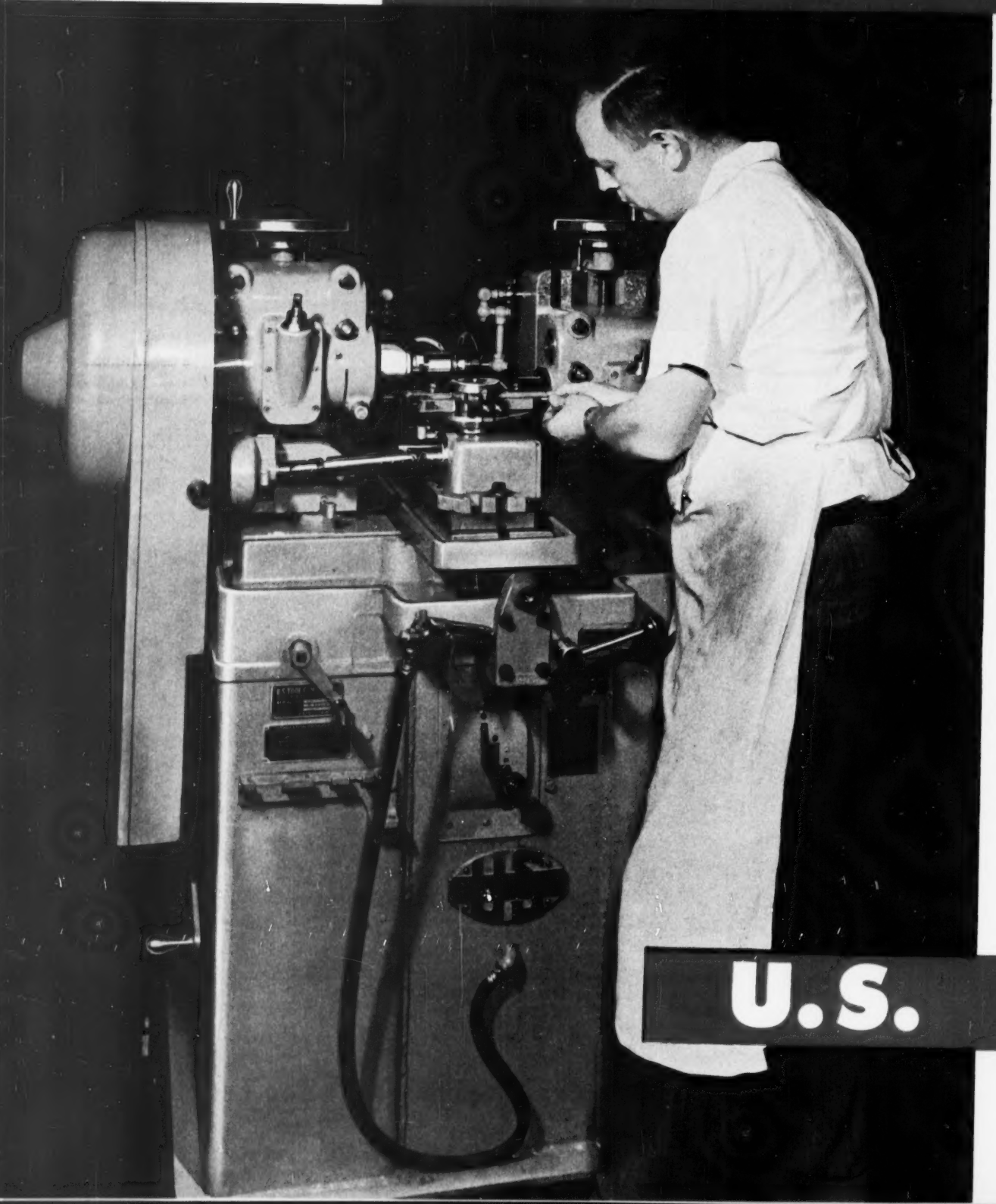
QUICK SETUP FOR GRINDING TAPERS —Desired taper angle measured with calibrated scale on swivelling regulating wheelbase. Wheel life prolonged as there is no need to dress taper on wheels.

QUICK CHECK OF WORK BLADE ALIGNMENT— Indicator mounted on base shows at a glance if work blade and grinding wheel spindle are in alignment. Hydraulic traverse of base makes checking fast and easy.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

For Profitable Production of Small and Medium Sized Parts

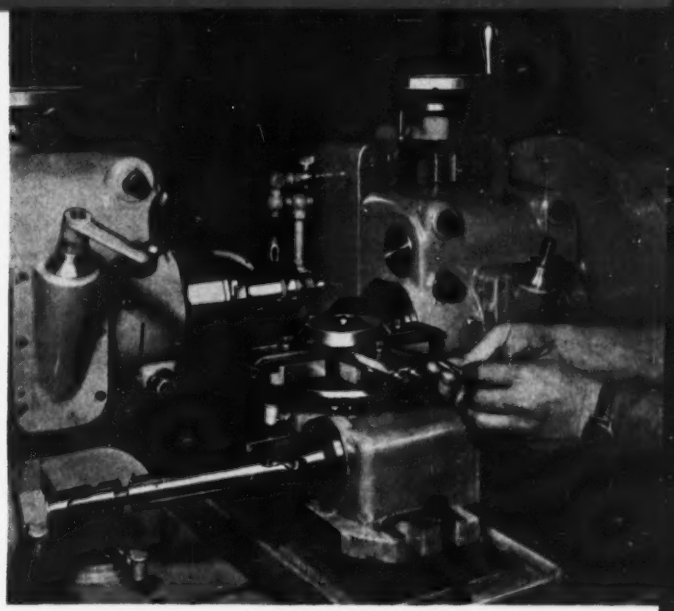
The U. S.



U.S.

MULTI-MILLER

1,440 Slots Milled per Hour on Small Precision Part!



EQUIPMENT USED—The setup illustrated by the photographs on this and the facing page consists of a U. S. Duplex Multi-Miller with two opposed spindles arranged with a four-station automatic indexing fixture to mill two slots spaced 180° apart on two pieces simultaneously.

PROCEDURE—The operation of the machine is automatic except for the loading and unloading of the pieces by the operator. Once started, the machine does not stop. The loading and unloading of the four-station automatic indexing fixture takes place during the machine cycle. The cycles of table feed and indexing are entirely automatic.

PRODUCTION—Two completed pieces (with two slots in each) are produced at each cycle of the machine, which is ten seconds. Since two pieces are produced per cycle, the gross production is 720 pieces per hour, or a total of 1,440 slots.

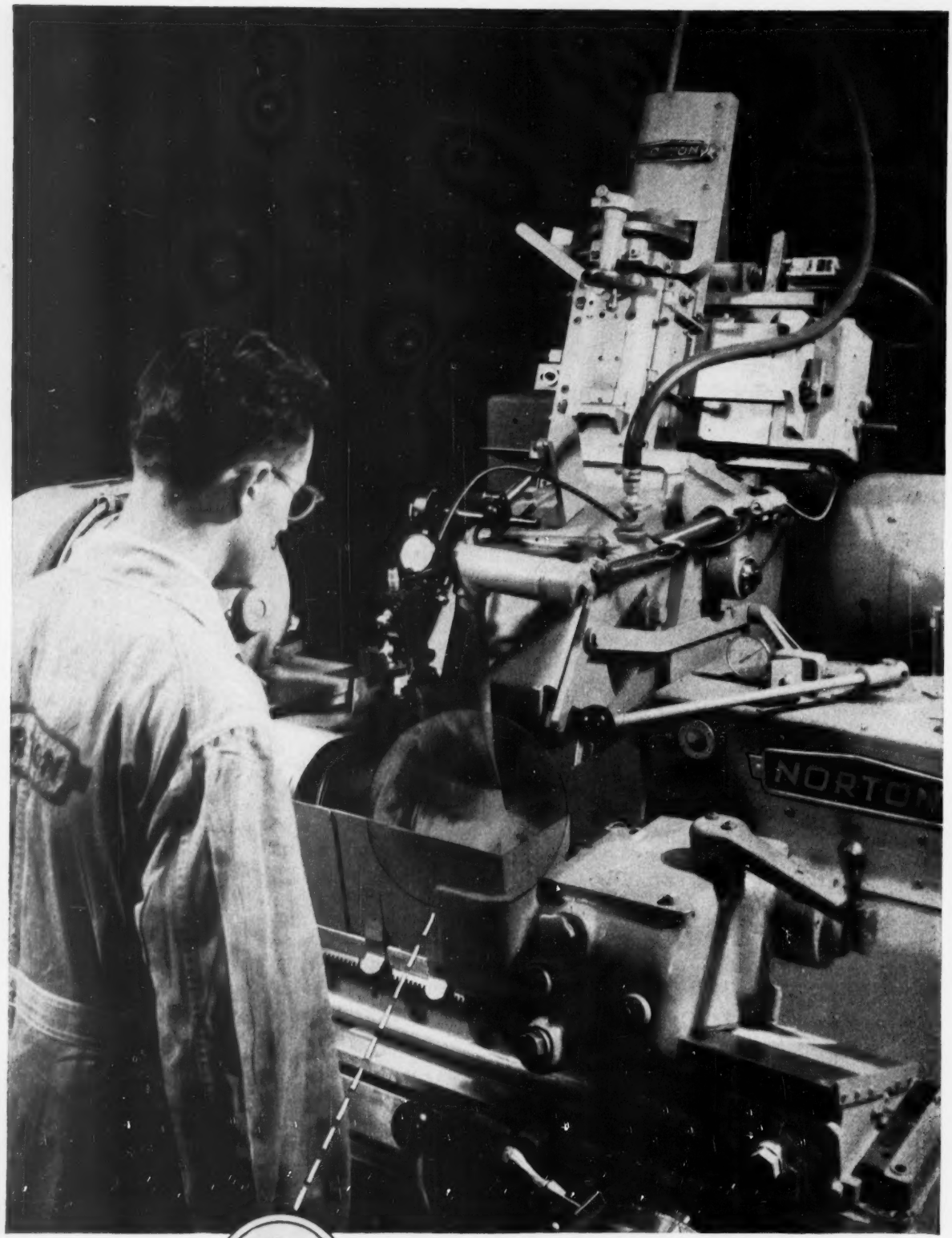
If your operations include milling on small and medium sized pieces, the U. S. Multi-Miller may be the answer to some of your production problems. Ask for a copy of Bulletin 25-M, which contains complete specifications.

TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories



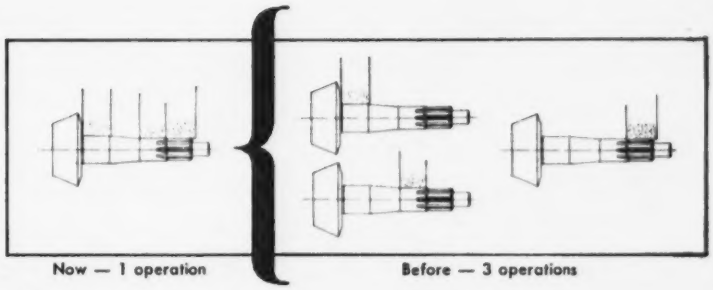
Up 128%

A big step forward in grinding operations, this Norton 10" Type CTU Semiautomatic Grinding Machine includes many advanced features. For example, the multi-wheel mount and automatic wheel guard type truing device help add the production-boosting, cost-cutting "Touch of Gold."

Now!...production increased 128% with this 3-way

"TOUCH OF GOLD"

A single Norton 10" CTU Semiautomatic replaces 3 separate grinders... cuts time, labor, costs



Here's an actual grinding job that shows clearly how advanced grinding techniques can reduce capital investment and step up production to new, profit-boosting highs.

THE PROBLEM. In producing an automotive part, a manufacturer was performing three separate grinding operations. Seeking to better his rate of 35 complete parts per hour per machine, he put his problem up to Norton engineers. They recommended replacing his three old-type machines with a single Norton 10" Type CTU Semiautomatic Grinder with multi-wheel mount and automatic truing device.

THE PAYOFF. Results were real eye-openers. The new Norton Grinder accurately performs all three operations at once . . . and produces 80 parts per hour for a rate increase of 128%!

Many examples of the "Touch of Gold"

That's just one of many instances of how Norton grinders and lappers assure the "Touch of Gold" that means sure savings in time, labor and money. There are many others. For example, another 10" Type CTU upped production from 300 to 600 parts per hour, replacing two old-type machines. And a 6" Type CTU more than doubled production of a part that previously required two separate grinding operations.

Why not add these advantages to your own production? Remember: only Norton offers you such long experience in both grinding wheels and machines to bring you the "Touch of Gold" — to help you produce more at lower cost.

For complete information, see your Norton Representative or write us direct. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

***To Economize, Modernize With* NEW**

NORTON

GRINDERS and LAPPERS

Making better products... to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit

PAINSTAKING PROCESSING THAT PAYS OFF —

BALANCED Action

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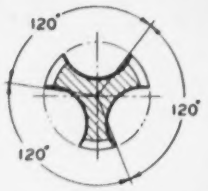
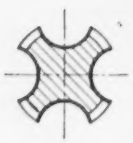
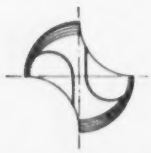


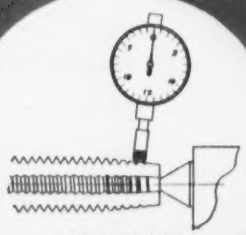
EXACT FLUTE SPACING



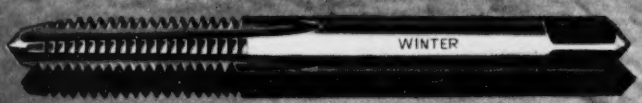
UNIFORMITY OF FLUTE CONTOURS

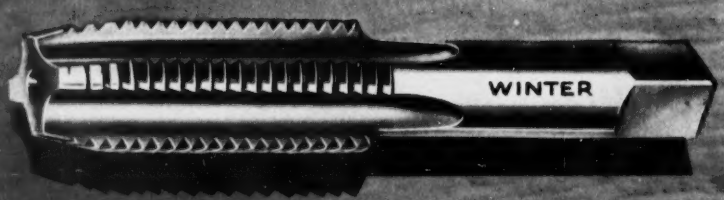


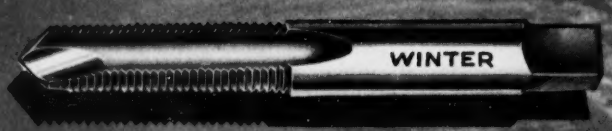
PRECISION CHIP DRIVER CONTOURS



ACCURATE AND CONCENTRIC CHAMFERS







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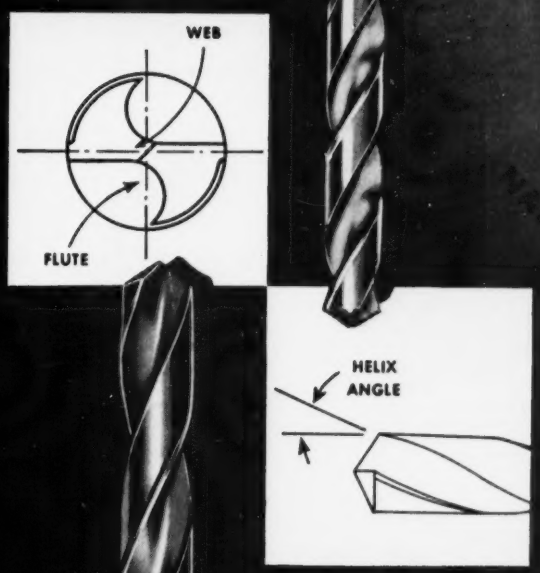

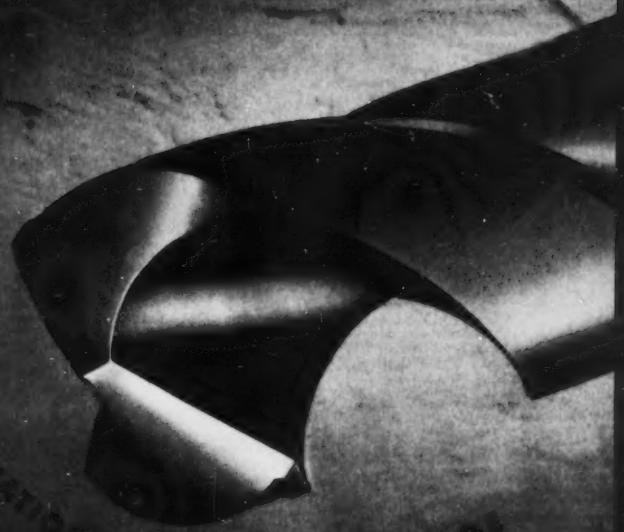

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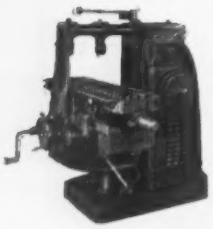
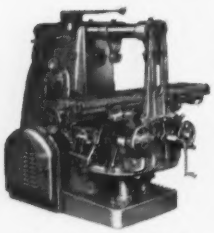
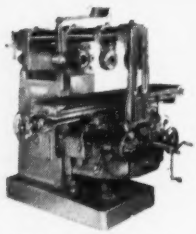


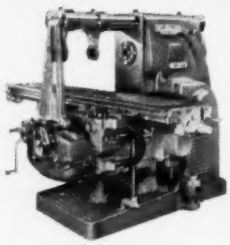
3hp, 24" Model AC Plain style with Mono-Lever and Automatic Cycle Table Control.



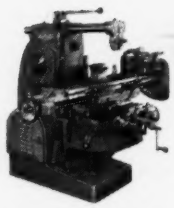
10hp No. 2 Model CK Plain style with Standard Directional Table Control.



30/15hp No. 3 Model HS Plain style (High Speed—3600 and 7200 rpm), for milling non-ferrous metals.

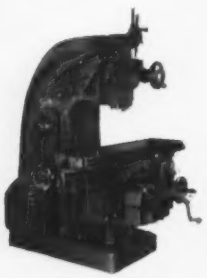


50hp No. 5 Model CSM Plain style with Mono-Lever and Automatic Cycle Table Control.

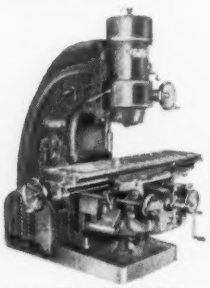


3hp No. 2 Model CHL Universal with Model H Dividing Head and Low Lead Attachment.

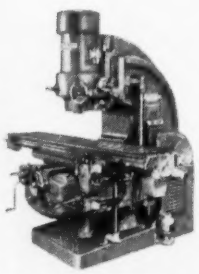
3hp 24" Model AC Vertical with Mono-Lever and Automatic Cycle Table Control.



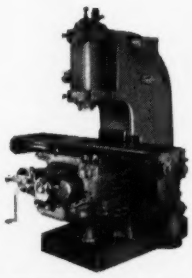
5hp No. 2 Model CH Vertical with Mono-Lever and Automatic Cycle Table Control.



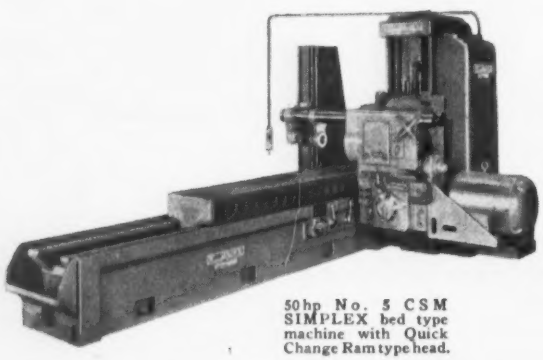
10hp No. 2 Model CK Vertical with Standard Directional Table Control.



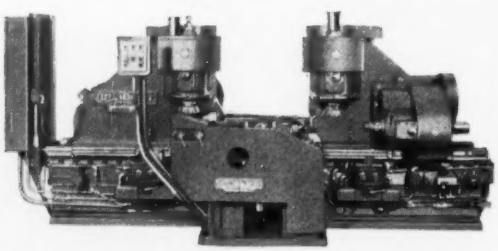
50hp No. 4 Model CSM Vertical with Mono-Lever and Automatic Cycle Table Control.



30/15hp No. 3 Model HS Vertical (High Speed—3600 and 7200 rpm), with Mono-Lever and Automatic Cycle Table Control.



50hp No. 5 CSM SIMPLEX bed type machine with Quick Change Ram type head.



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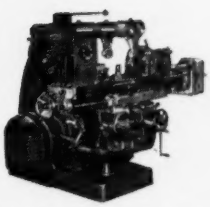
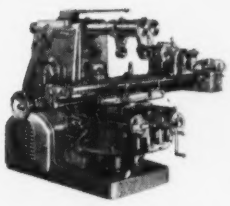
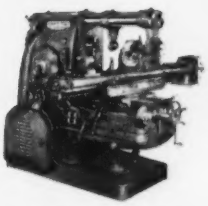


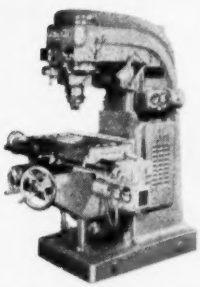
10 hp No. 2 Model CK Universal with Model K Dividing Head and Conventional Lead Attachment.



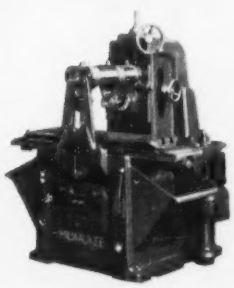
15 hp No. 3 Model CK Universal with Model K Dividing Head and Low Lead Attachment.



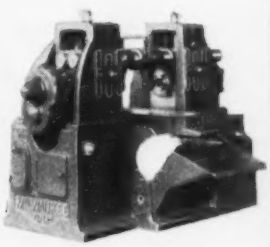
25 hp No. 4 Model CK Universal with Model K Dividing Head and Low Lead Attachment



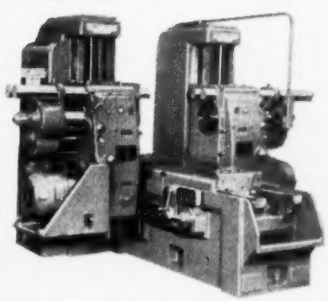
Model 2D ROTARY HEAD MILLING MACHINE transmits complete blueprint into metal without changing setup.



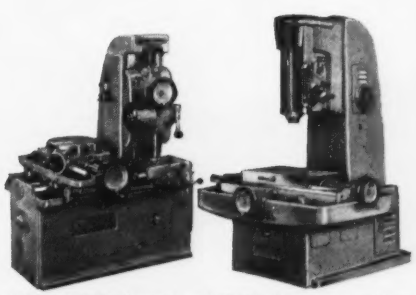
5 hp M-24 SIMPLEX bed type — an exceptionally versatile production machine.



1200-1800 SERIES DUPLEX 10 hp bed type machine.



20 hp No. 2 CSM DUPLEX bed type machine with Quill type Pick-off Head.



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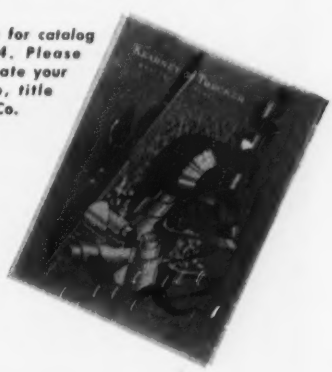

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For complete details on this 5" spindle, 25-hp machine — or for information on all G&L quality-built Horizontal bars with 3-4-5-6 or 7" spindles; in table, floor or planer types — contact your G&L representative or write —

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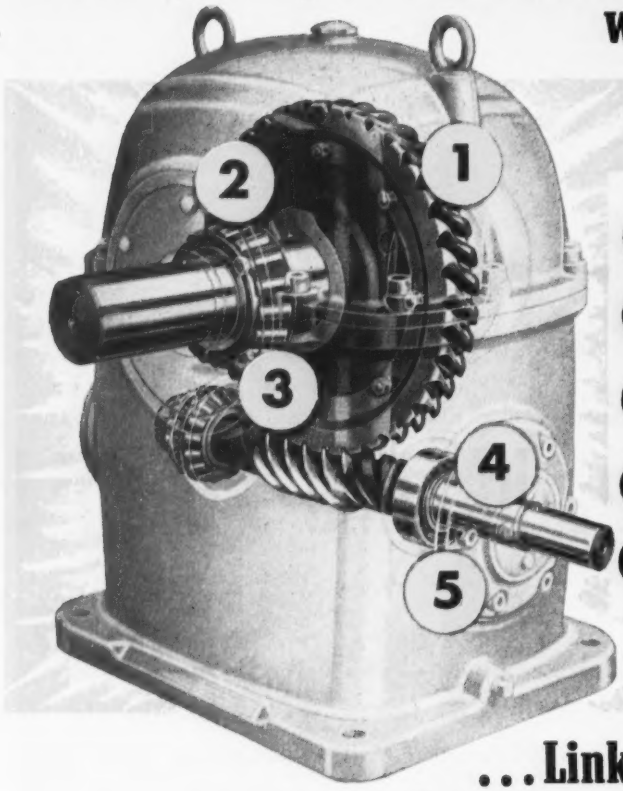
Photo courtesy of Magna Mill Products, South Gate, Calif.

When your speed reduction job calls for high ratios with right-angle takeoff...



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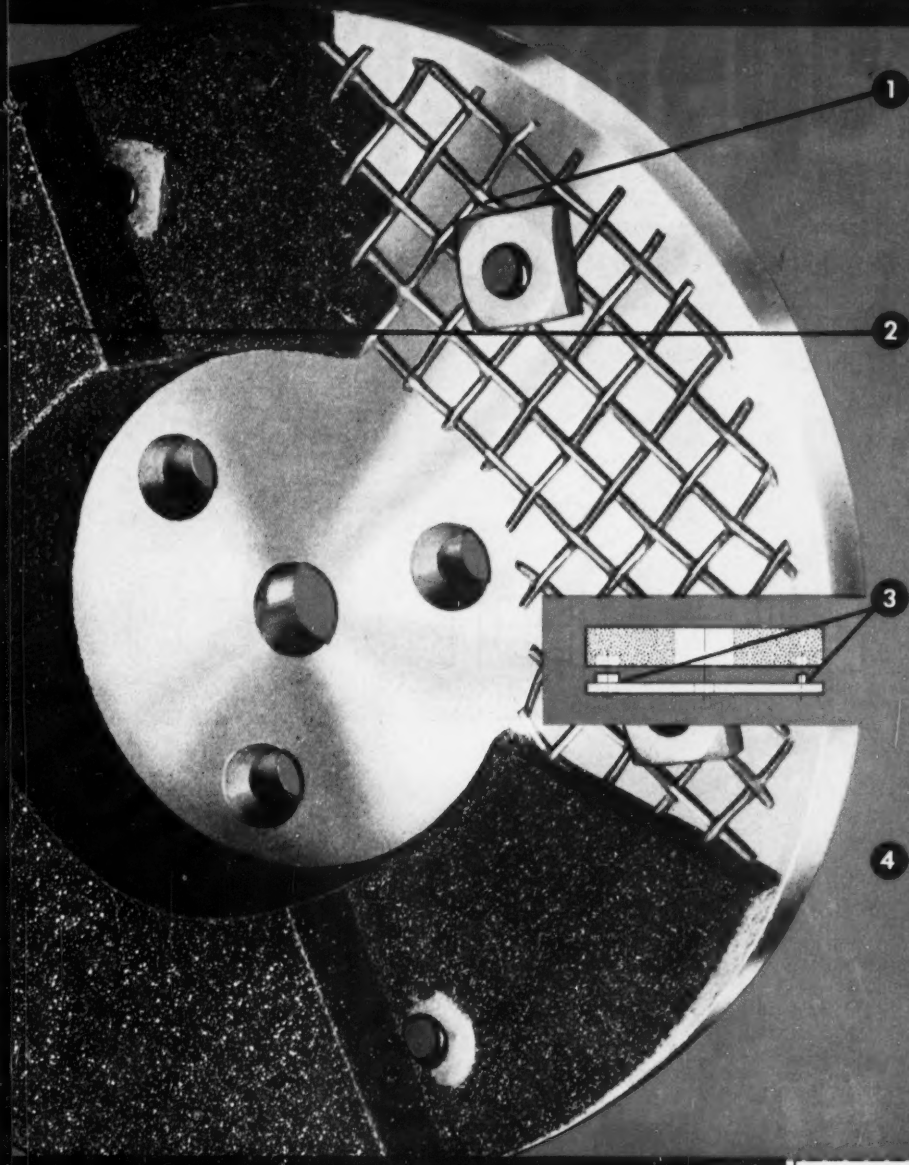
Compare the Exclusive Features

of This Abrasive Disc With Other Makes



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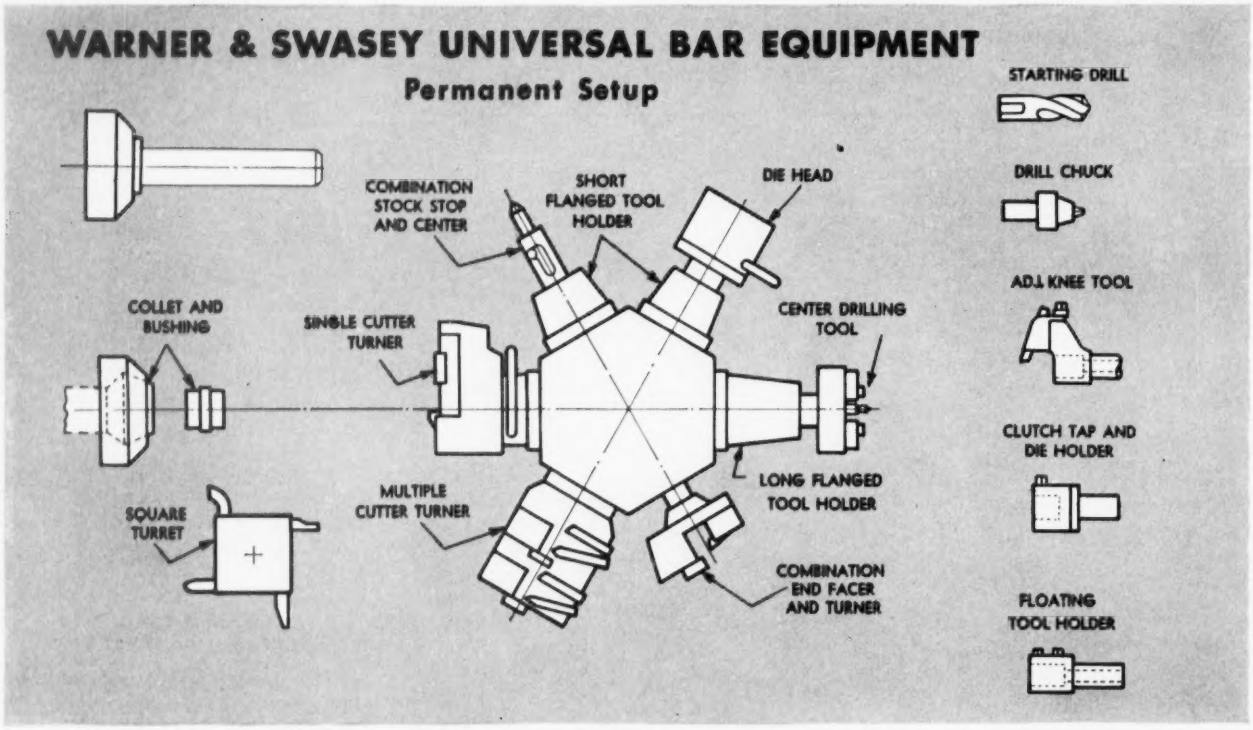

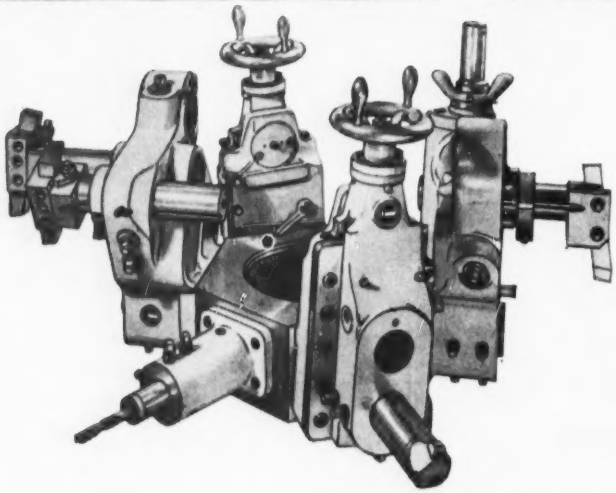

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Your Production!

This free book tells you how...

Yes, *you* can make Warner & Swasey standard turret lathe tools and Universal Tooling Setups *pay off*—with increased production, less setup, handling and cutting time, longer tool life. This free book clearly and simply explains how to select tools and improve setups, combined and multiple cuts, and many other modern tool applications. Fill in and mail the handy coupon for your free copy—*today!*

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

2-54

WARNER & SWASEY COMPANY
Department 320- M, Cleveland 3, Ohio

Please send me my free copy of "Turret Lathe Tools" today!

Name .....

Company .....

Position .....

Address .....

City ..... *Zone* ..... *State* .....

MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

For more information on products advertised, use Inquiry Card, page 243

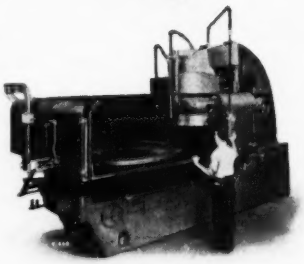
Put it on the Blanchard...
it takes 1/5th the time!

Here is another example of the high production attainable while grinding to extremely close tolerances with Blanchard Surface Grinders and Blanchard Wheels.

It formerly took 45 hours, floor-to-floor, to grind these nine hardened steel machine tool ways. They are 2½" x 3½" x 50" and hardened to Rockwell C-60-63.

Now, these highly desirable results are obtained, using a No. 42-72-84 Blanchard Surface Grinder — nine are placed on the chuck and ground on 6 sides, removing .015" from each surface, parallel to .0001", flat within .0001" with surface finish of 5 micro-inches. The Blanchard **cut time to 9 hours,** floor-to-floor!

No wonder production men say: "Put it on the Blanchard — it takes less time to do a better job".



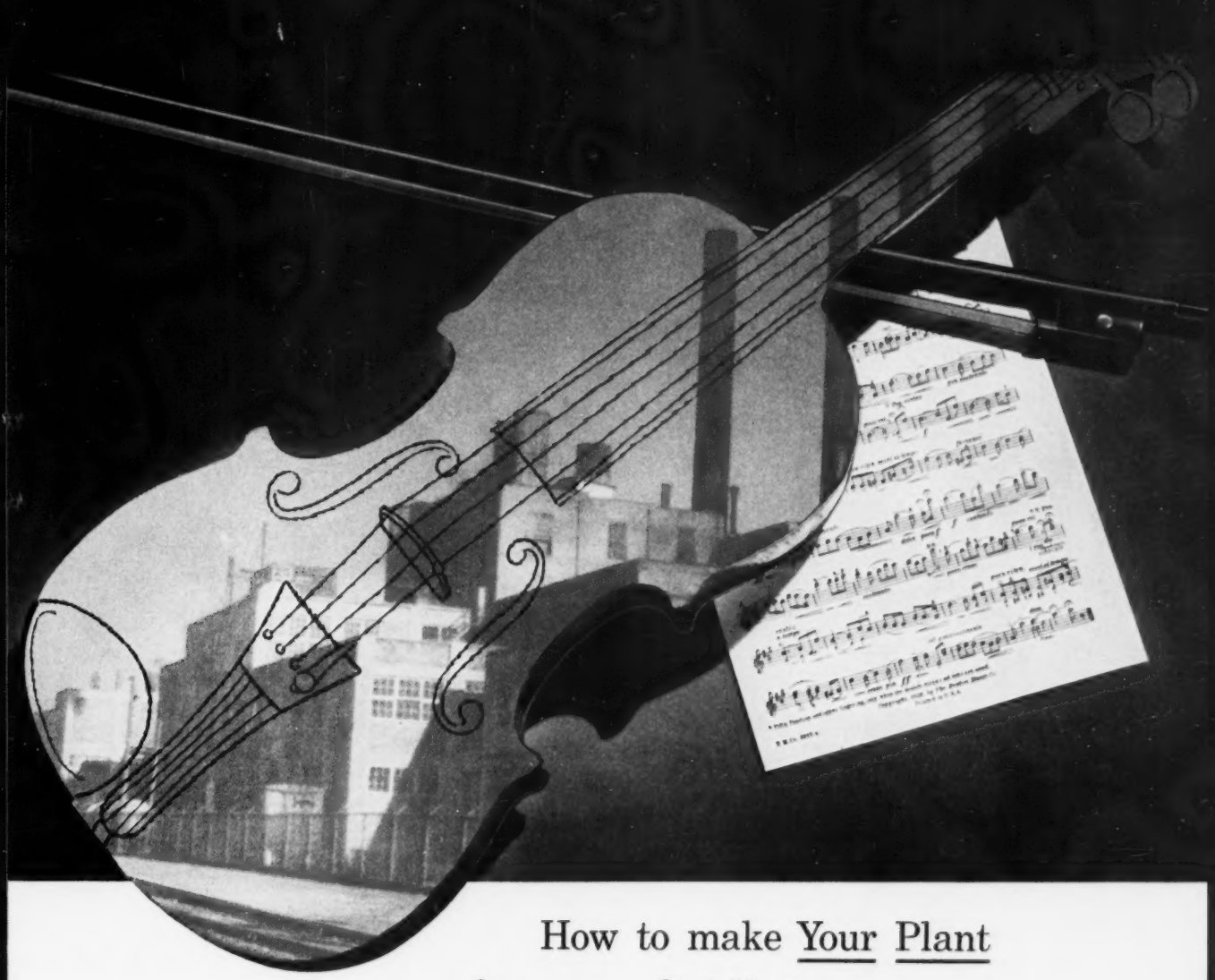
This is the largest Blanchard Surface Grinder, No. 42-72-84.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

For more information on products advertised, use Inquiry Card, page 243



How to make Your Plant fit as a fiddle!

SWITCH TO CIMCOOL°, and listen to the sweet music of your machines as they run faster, smoother than ever. Then listen to the happy melody of your adding machines totaling the money saved. For this revolutionary cutting fluid—this *chemical emulsion*—lowers costs three important ways:

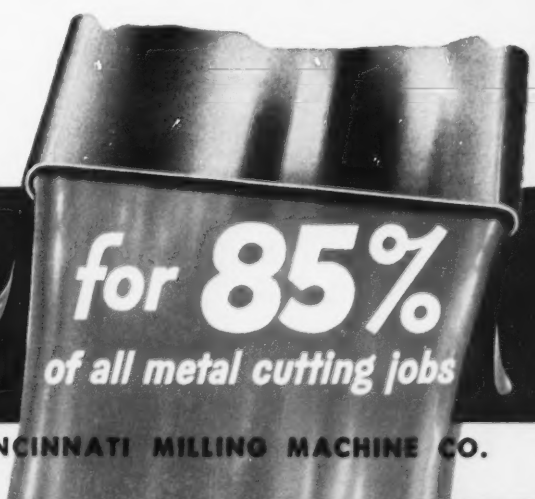
CIMCOOL INCREASES TOOL LIFE (and thus reduces down time) because of its *chemical lubricity*.

FASTER SPEEDS are possible because Cimcool *cools faster*, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.

CIMCOOL COSTS LESS than old-fashioned cutting fluids because it *lasts longer*. It also cuts labor costs for cleaning and changing. It virtually eliminates rancidity and foul odors. And, because of its low surface tension and low adhesion to work and chips, there is practically no carry off.

For a demonstration of how to make your machines *sing—for a song*—just write us. We'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "Cimcool Defeats Heat." Address Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

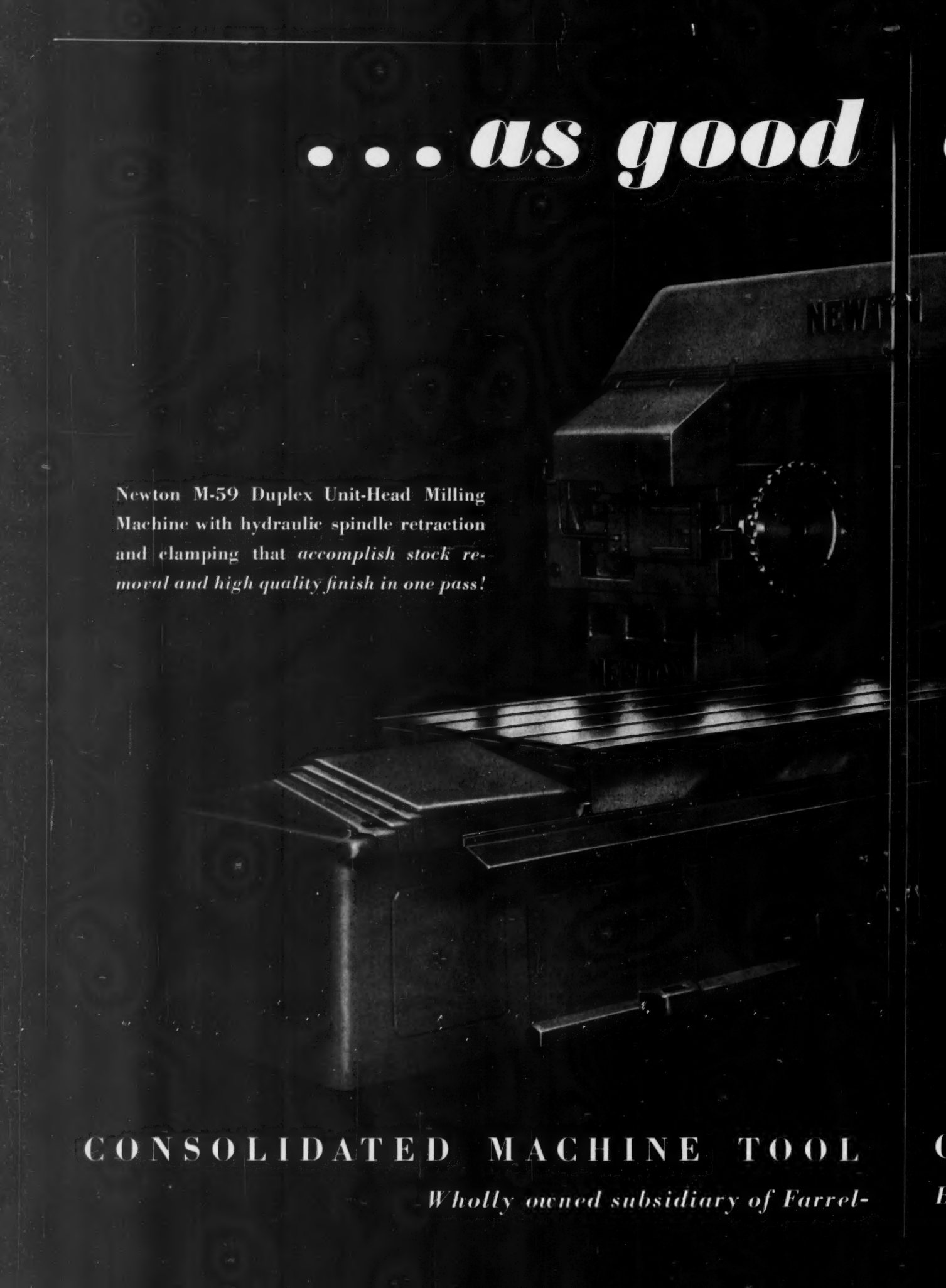
°Trade Mark Reg. U.S. Pat. Off.



CIMCOOL for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

. . . as good



Newton M-59 Duplex Unit-Head Milling Machine with hydraulic spindle retraction and clamping that *accomplish stock removal and high quality finish in one pass!*

CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-

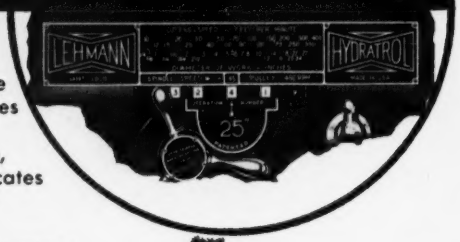
as it looks!

CONSOLIDATED MACHINE TOOLS

CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated

Just a "Twist of the Wrist" does it! ...The Lehmann HYDRATROL LATHE gives 16 Spindle Speed changes with Automatic Slide Rule Selection.



Just a turn of the hand wheel on the front of the headstock of the LEHMANN Hydratrol Lathe gives you a speed change! An automatic slide rule, co-ordinated with the movement of the handle, shows spindle revolutions per minute and indicates a slide rule calculation of the cutting speeds in feet per minute.

Calculation by the operator is unnecessary. The rotary handle provides all speed changes for 16 forward and 8 reverse speeds. No need for intermediate stop; unnecessary to disengage the friction driving clutch to change speed.

Check These Other Important Advantages:

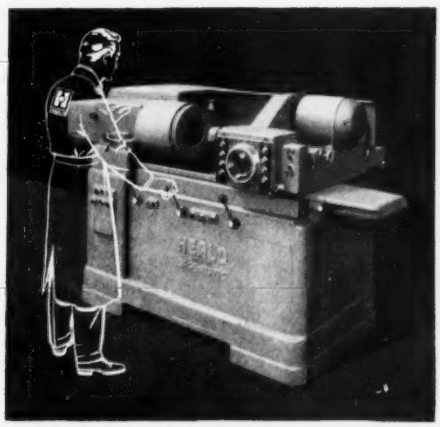
- Safe in operation.
- Simplicity in construction and operation.
- Hydraulic friction clutches and hydraulic brakes, self-compensating.
- Automatic safety relay, for harmless and easy engagement of positive clutches when speeds are changed.
- Spindle release for chucking.
- Perfect, safety-control lubrication with filtered oil.
- Gears constantly in mesh.

Write today for additional information or catalog — or — send prints for time-and-money-saving recommendation!

LEHMANN MACHINE COMPANY GRAND AT CHOUTEAU • ST. LOUIS 3, MO.
DIVISION OF NOVO ENGINE CO.

For more information on products advertised, use Inquiry Card, page 243

Heald Internal outproduces older equipment by nearly



This Heald Model 271 Gage-Matic grinds ring gear bores nearly as fast as two older machines.

THIS might be just another case history, except for one thing — a production increase of almost 100 per cent. And that's a pretty important saving in any production man's language.

A Heald Model 271 Gage-Matic was installed by an automotive manufacturer for grinding the bore of differential ring gears. A simple, straightforward operation — yet it was found that this new Internal out-produced *two* older machines by almost two-to-one! Why? Because all of the new Heald machines have been designed to save time and effort on *every phase* of the operating cycle. It all adds up to a substantial increase in production efficiency.

Remember — when it comes to precision finishing, it pays to come to Heald.

Internal and Rotary Surface Grinding Machines and Bore-Matics

HEALD

THE HEALD MACHINE COMPANY

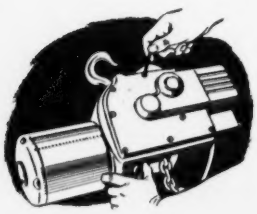
WORCESTER 6, MASSACHUSETTS

Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

For more information on products advertised, use Inquiry Card, page 243

23 UNBRAKO Socket Head Cap Screws are used to assemble this lightweight, high efficiency electric hoist. They were selected for their uniform accuracy and high tensile strength.

The knurling on the head of UNBRAKO Socket Head Cap Screws permits faster assembly, because of the positive slip-proof grip.



The uniform depth and size of the hex socket assure strength and maximum torque in wrenching—extremely important in the cap screws used to fasten assemblies like this.

UNBRAKOs—made of heat treated alloy steel—have fully formed threads, Class 3 fit; controlled fillet and continuous grain flow for strength. In standard sizes from # 4 to 1".

Save time and money by using UNBRAKO Standards...stocked by your distributor

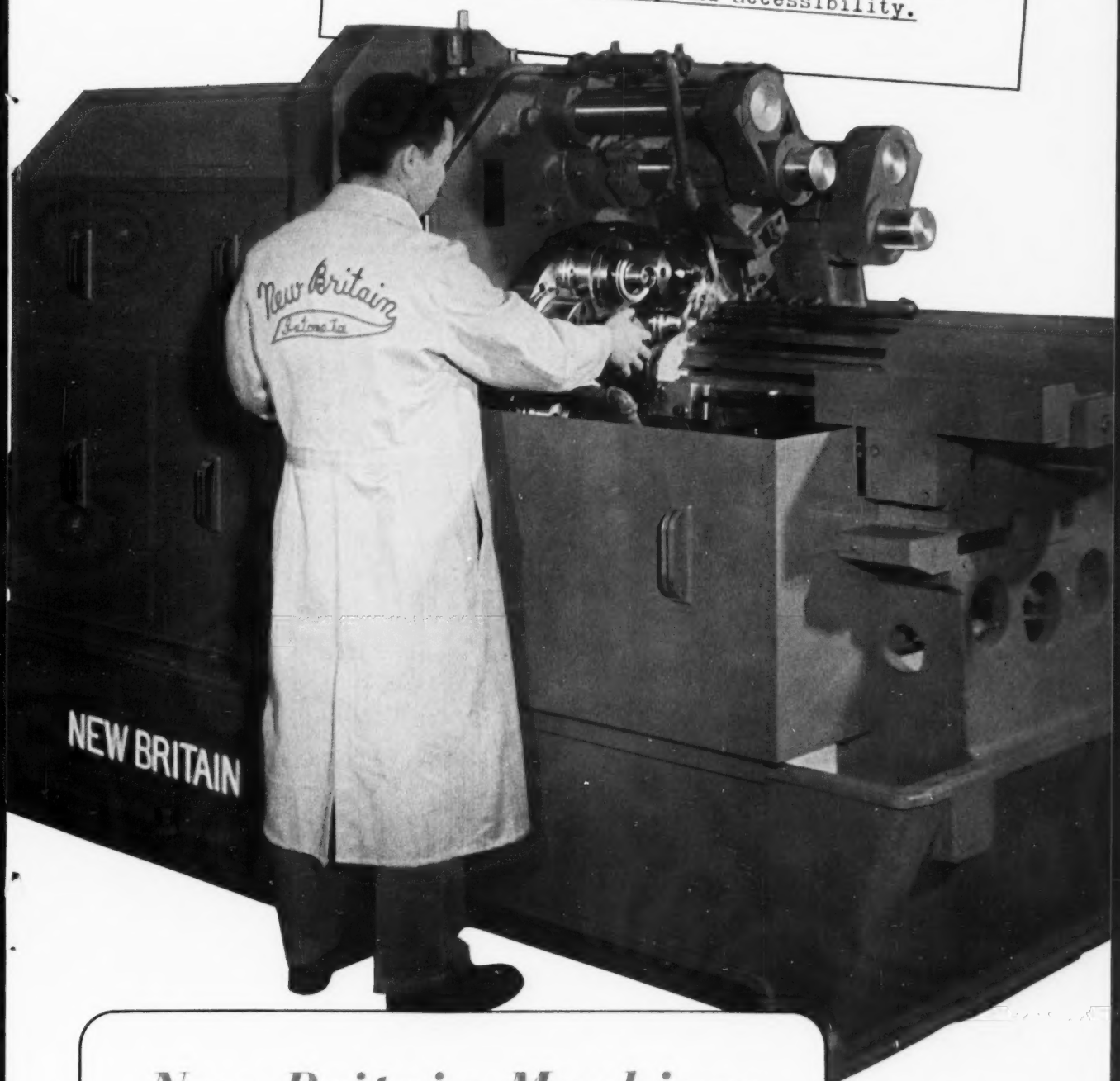
You'll have less money tied up in inventory, you'll need less space for storage, you'll get personalized service and faster deliveries. And you'll be buying the finest socket screw products that modern machines, complete facilities and quality control can produce. Write for UNBRAKO Standards, a complete listing of socket screw products made by the world's largest producer. STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

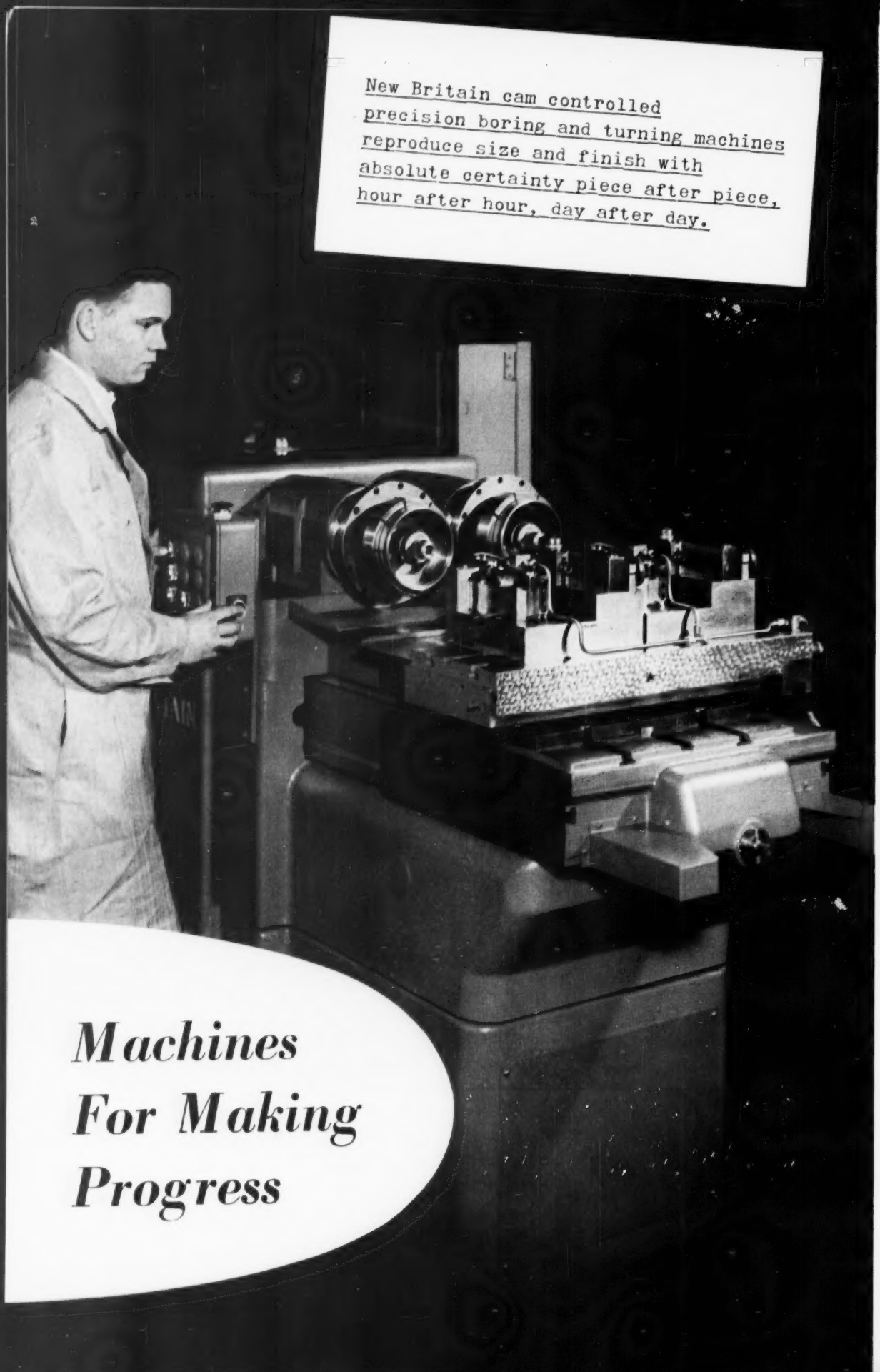
For more information on products advertised, use Inquiry Card, page 243

This line of open end New Britain automatic chucking machines for creating greater profits, includes four, six and eight spindle machines up to 12" capacity. All notable for greater productivity, rigidity and accessibility.

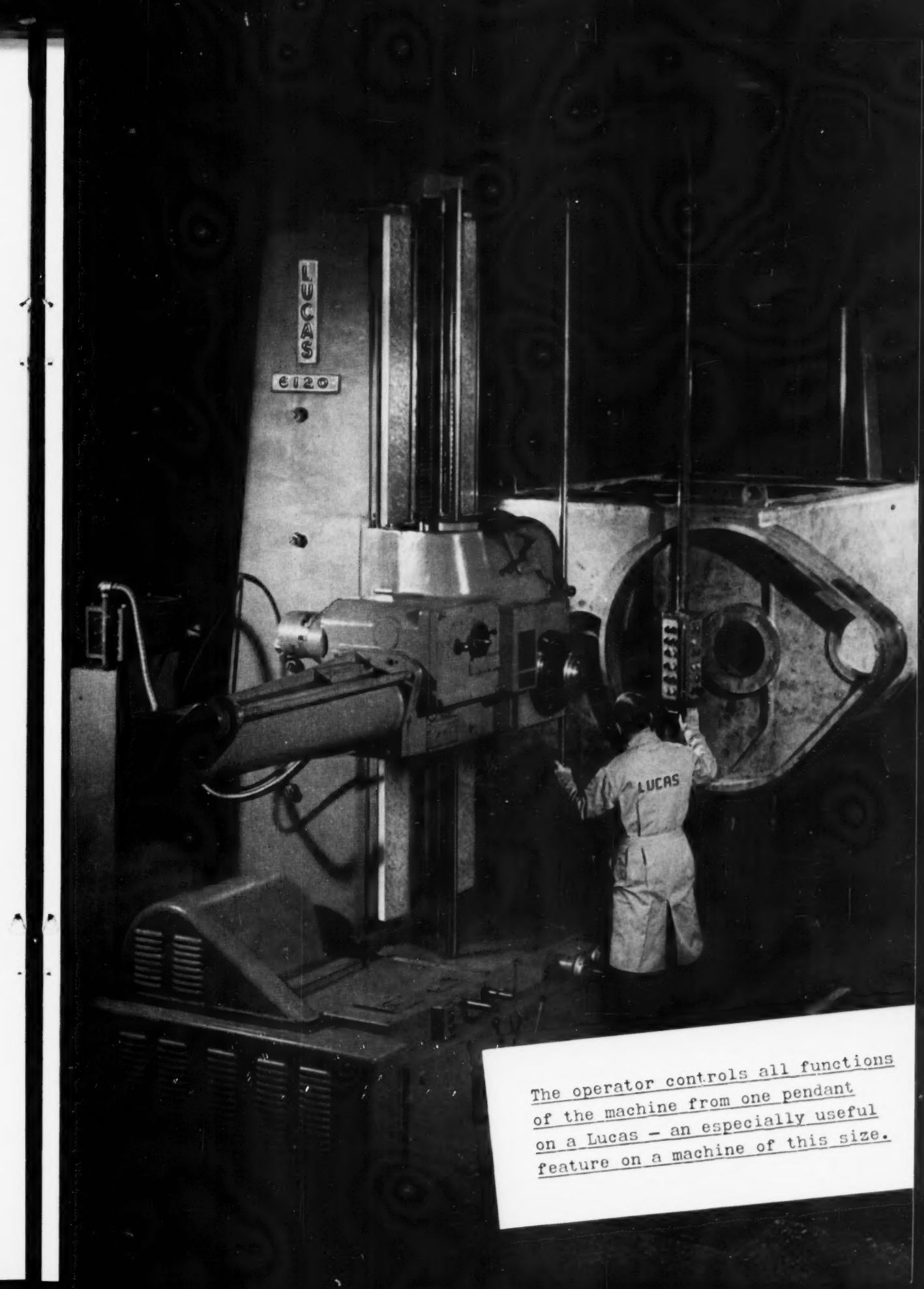


New Britain Machines
For Making Progress

NB LUCAS CLEVELAND


New Britain cam controlled
precision boring and turning machines
reproduce size and finish with
absolute certainty piece after piece,
hour after hour, day after day.

Machines For Making Progress



The operator controls all functions of the machine from one pendant on a Lucas – an especially useful feature on a machine of this size.

MACHINES *for* MAKING PROGRESS

HALF a century is a brief time for accomplishing the change from "horse-and-buggy" days to our present way of life. The never-ending search for *better methods* is chiefly responsible for this progress.

Throughout the twentieth century many of the improvements in metalworking methods have been contributed by New Britain and Lucas. The machines we have developed play an important part in improving standards of living in time of peace — and defending them in wartime.

The New Britain +GF+ Copying Lathe — a completely new approach to contour turning and boring. Fast, productive and profitable.

NB LUCAS CLEVELAND

AUTOMATIC BAR AND CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING & MILLING MACHINES
NEW BRITAIN +GF+ COPYING LATHES

The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut
Lucas Machine Division, Cleveland 8, Ohio

For Atlantic Automatic Co., Cleveland, Ohio:

Tool Life Increased Over 200%!

PARTS FOR GEARS & CAR TRANSMISSIONS are just a few of the many delicate machine tool products Atlantic turns out. Cities Service Chillo Cutting Oil has helped Atlantic maintain their great reputation for quality products.

For the services of a Cities Service Lubrication Engineer... Write Cities Service Oil Company, Sixty Wall Tower, New York City 5, New York.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

"Cities Service Chillo Cutting Oil Has Proved To Be The Difference Between Ordinary And Quality Production In Our Shop!"

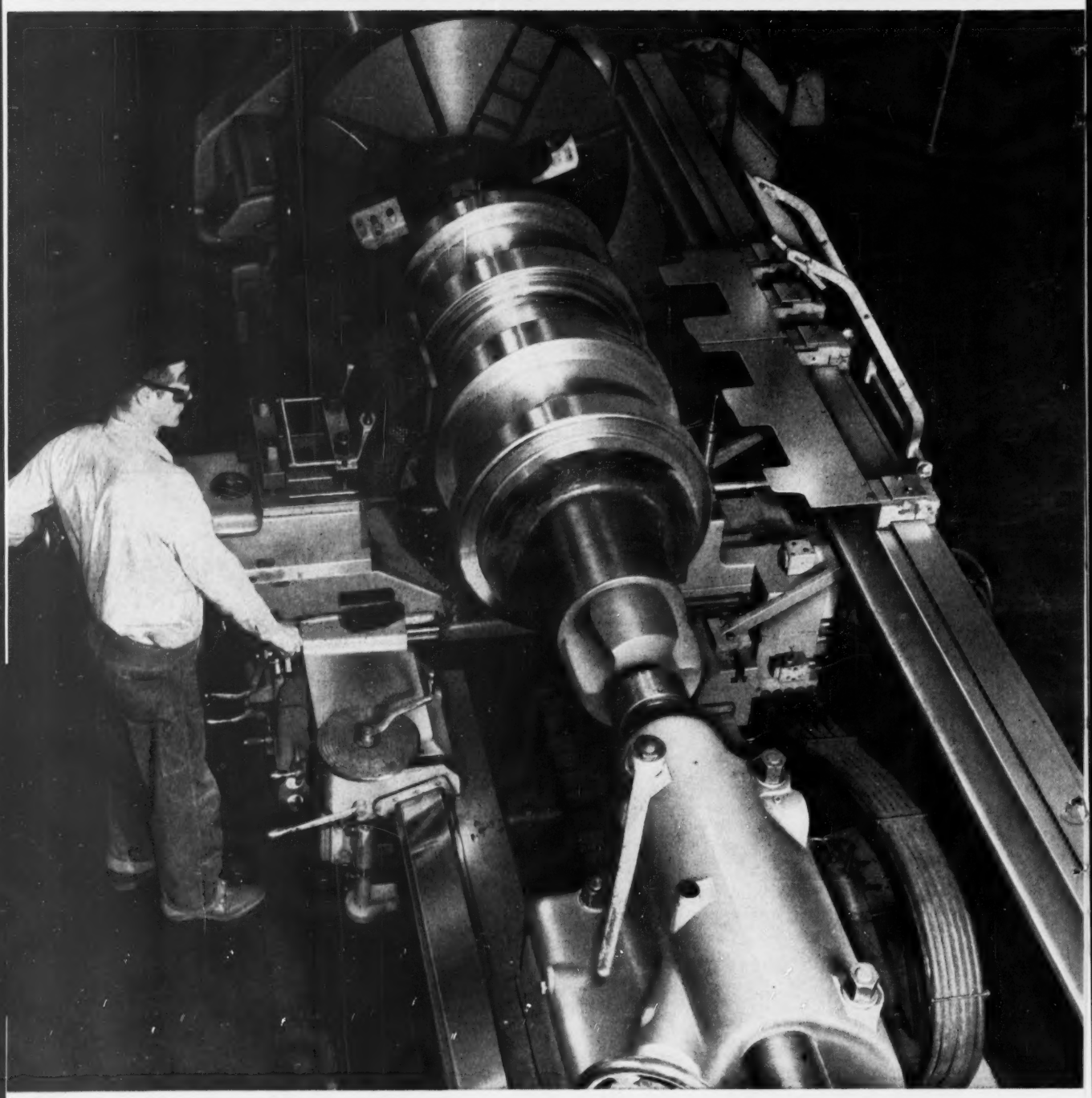
Here's Atlantic Automatic's story in their own words: "One of our tougher jobs recently was machining SAE 446 Stainless Steel with two forming, one threading and three drilling operations. The critical operation was drilling a .025 inch diameter hole, ⅛ inch deep. The drill would soon pack with chips and break. When a Cities Service Lubrication Engineer was called in, he recommended our using Chillo 44.

"This light-colored oil did the trick. DOWN TIME WAS CUT IN HALF AND DRILL LIFE INCREASED OVER 200%!

"We use Cities Service Chillo 44 to machine all types of metals covering a range of machinability from brass to stainless on our Brown and Sharpe 00G, 0G and 2G Automatics. It has proved to be the difference between ordinary and quality production in our shop!"

For more information on products advertised, use Inquiry Card, page 243

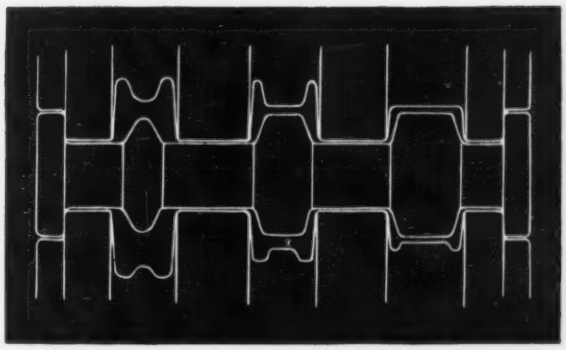
LeBlond Lathe eases cost squeeze ...on rolls that



A set of Shape rolls of 30½" dia. x 51" body cast alloy semi-steel are turned to .005" tolerance in 94 hours on this 50" LeBlond Roll Contouring Lathe. Set-up time—¼ hour. Clamped-on and brazed-on carbide tips are used at 48 rpm, .040 ipr feed. Conventional roll lathe took 245 hours for the same set of rolls.

squeeze channels from blooms

U. S. Steel
Lops 151 Hours Off
245-Hour Roll-Turning Job.



Typical roughing rolls for 8" channel

Every day at U. S. Steel's Clairton Works, Clairton, Pa., miles of "hotter-than-orange" steel are squeezed through the passes of rolls like these for reduction, elongation, shaping. They come out as finished structural steel for the "jungle-gym" frameworks of modern buildings. Turning these costly shape rolls with their steep-angle contours used to keep a lathe running *245 hours on a set of roughing rolls* at U. S. Steel. Tool life was short and the job required highly skilled operators. Stepped-up schedules called for a new solution to this tough-nut production problem.

A LeBlond 50" Roll Contouring Lathe, as recommended by Pittsburgh Distributor, Barney Machinery Co., immediately slashed the 245-hour turning time by an astonishing 61.7%. Now U. S. Steel *saves 151 hours on one set of roughing rolls*—more than enough time to turn out two more just like it. Tool life is greatly improved and less experienced operators can handle the work.

The 50" LeBlond Roll Contouring Lathe is equipped with two-directional hydraulic tracing. A single valve automatically controls two hydraulic motors for cross and length feed. A stylus follows a flat template mounted at the back of the lathe. Feed and speed can be varied during a cut without leaving a tool mark. For roughing, hydraulic cross feed can be by-passed and length feed used separately. This enables operator to cross feed manually, use template as length stop. Mechanical power rapid traverse to carriage and cross slide is also provided. All controls are located conveniently at the apron. The lathe uses a 40 constant horsepower DC motor, has nine speed changes in the headstock, delivers infinitely variable speeds from 1 to 165 rpm.

Whether your turning jobs involve specialized production like roll-turning, or call for high precision, high production—investigate LeBlond's complete line of 76 lathe models. LeBlond engineers will help you get a better turning job, faster. Write today or see your nearby LeBlond Distributor.

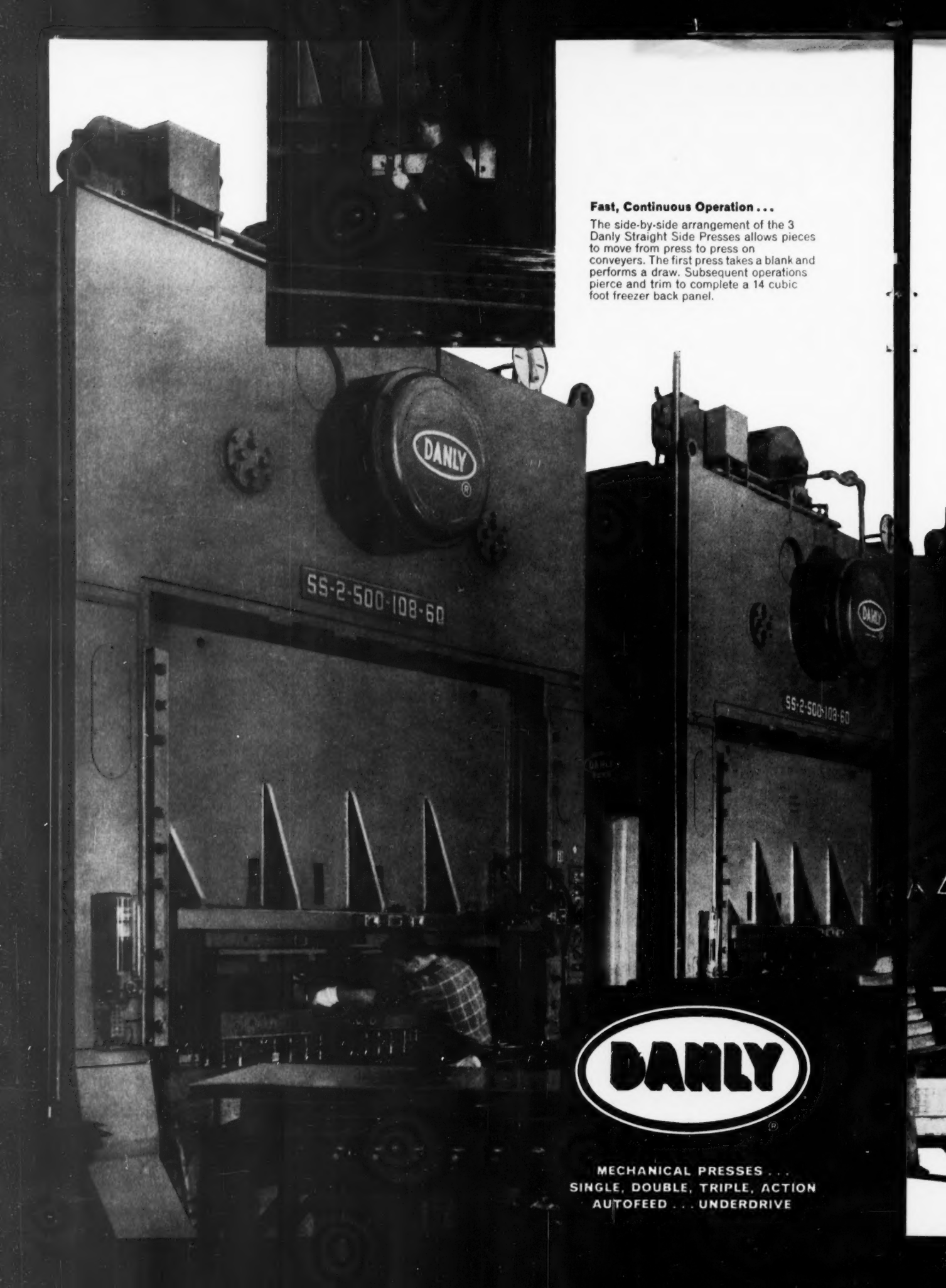
Ask for complete information on Roll Contouring Lathes in 25", 32", 40" and 50" sizes.

Turned faster by

LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • FOR MORE THAN 66 YEARS



Fast, Continuous Operation . . .

The side-by-side arrangement of the 3 Danly Straight Side Presses allows pieces to move from press to press on conveyers. The first press takes a blank and performs a draw. Subsequent operations pierce and trim to complete a 14 cubic foot freezer back panel.

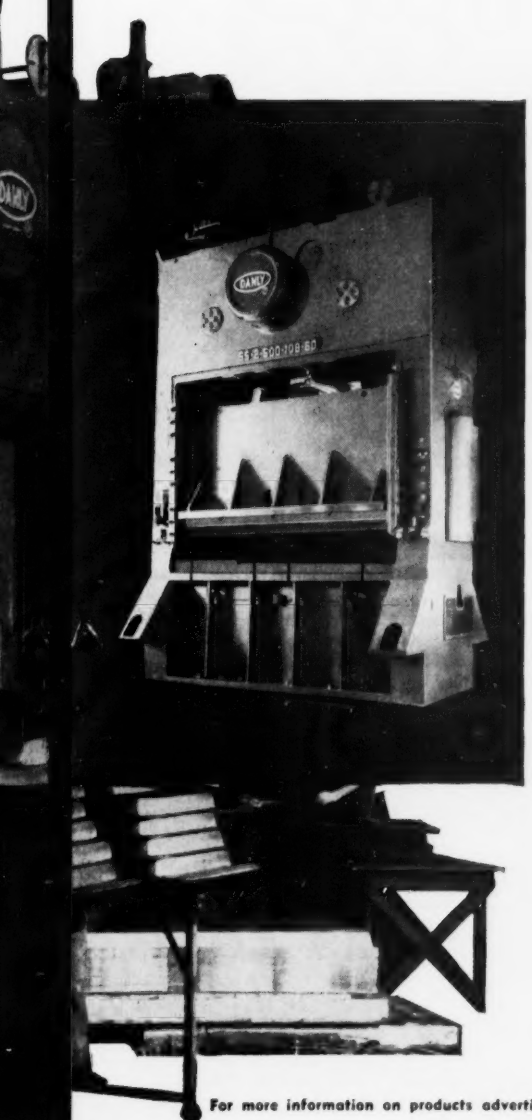
DANLY®

MECHANICAL PRESSES . . .
SINGLE, DOUBLE, TRIPLE, ACTION
AUTOFEED . . . UNDERDRIVE

How can you

maintain high stamping production

with frequent job changes?



GENERAL ELECTRIC COMPANY does it on their

DANLY PRESSES

Today it's 14 cubic foot freezer backs . . . tomorrow it may be any of 15 other stampings. With such frequent job changes and schedules pushing capacity to the limit, GE faced the problem of keeping production high and down-time losses low.

The solution? They found it in Danly 500-ton Straight Side Presses . . . setting new performance standards in meeting the demands of one of the most intensely competitive markets in American industry . . . uninterrupted production runs with minimum down-time for job changes or routine maintenance.

That's why you find more and more complete lines of Danly presses doing a better job in leading stamping plants like this. They're smoother, quieter and easier to operate for continuous production at full capacity. Why not prove it to yourself? Write for free booklet on Danly Straight Side Presses and get all the facts.

DANLY MACHINE SPECIALTIES, INC.

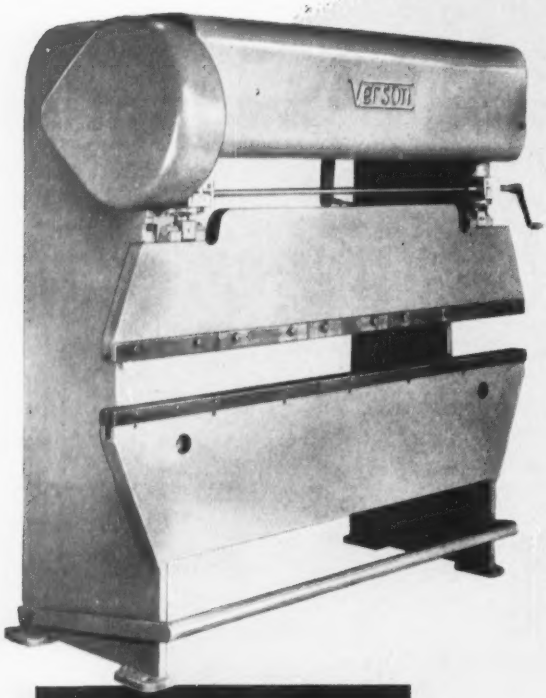
2100 South Laramie Avenue, Chicago 50, Illinois

It costs less to run a DANLY PRESS!

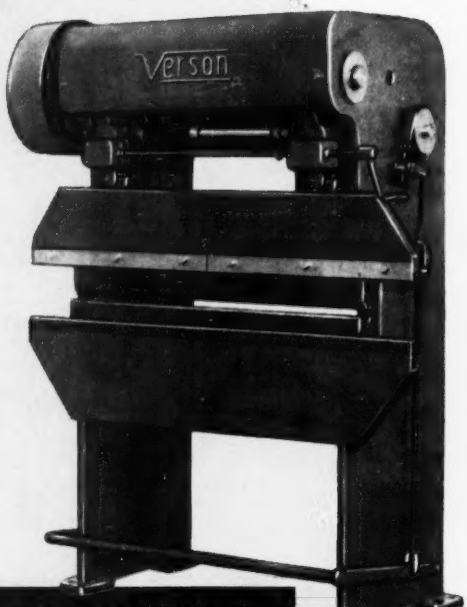
If your manufacturing process involves high production and expensive dies, it will probably be worth your while to talk with a Danly Press Engineer. Call now—he will be glad to discuss your specific problems. There is no obligation for this service.

Now, for the first time...

Standard Verson Press Brakes Available from Stock!



The 1062
25 tons capacity
(16 ga. x 78")
$2,190.00 as shown



The 16-48
15 tons capacity
(16 ga. x 48")
$1,455.00 as shown

Standard Dies Also Available

Standard 90° "V" dies for these press brakes are also available from stock. 78" long set for the 1062 is priced at $124.00. 48" long set for use in the 1062 or 16-48 is priced at $93.00. (Prices are for dies to handle 16 ga.).

To meet the demand for quality press brakes at modest cost and available for prompt delivery, Verson now offers two standard models *from stock.* For the small shop, it means big press standards of design and construction at prices that will fit almost any budget. For the larger shop, it means an economical answer to handling the smaller jobs without tying up big expensive machines.

Important, too, is the fact that you can order these machines as easily as buying an automobile. There is no involved proposal . . . no long delay awaiting delivery. These standard machines are offered at a standard price and shipped from stock.

Your Verson dealer can give you further information or write direct.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

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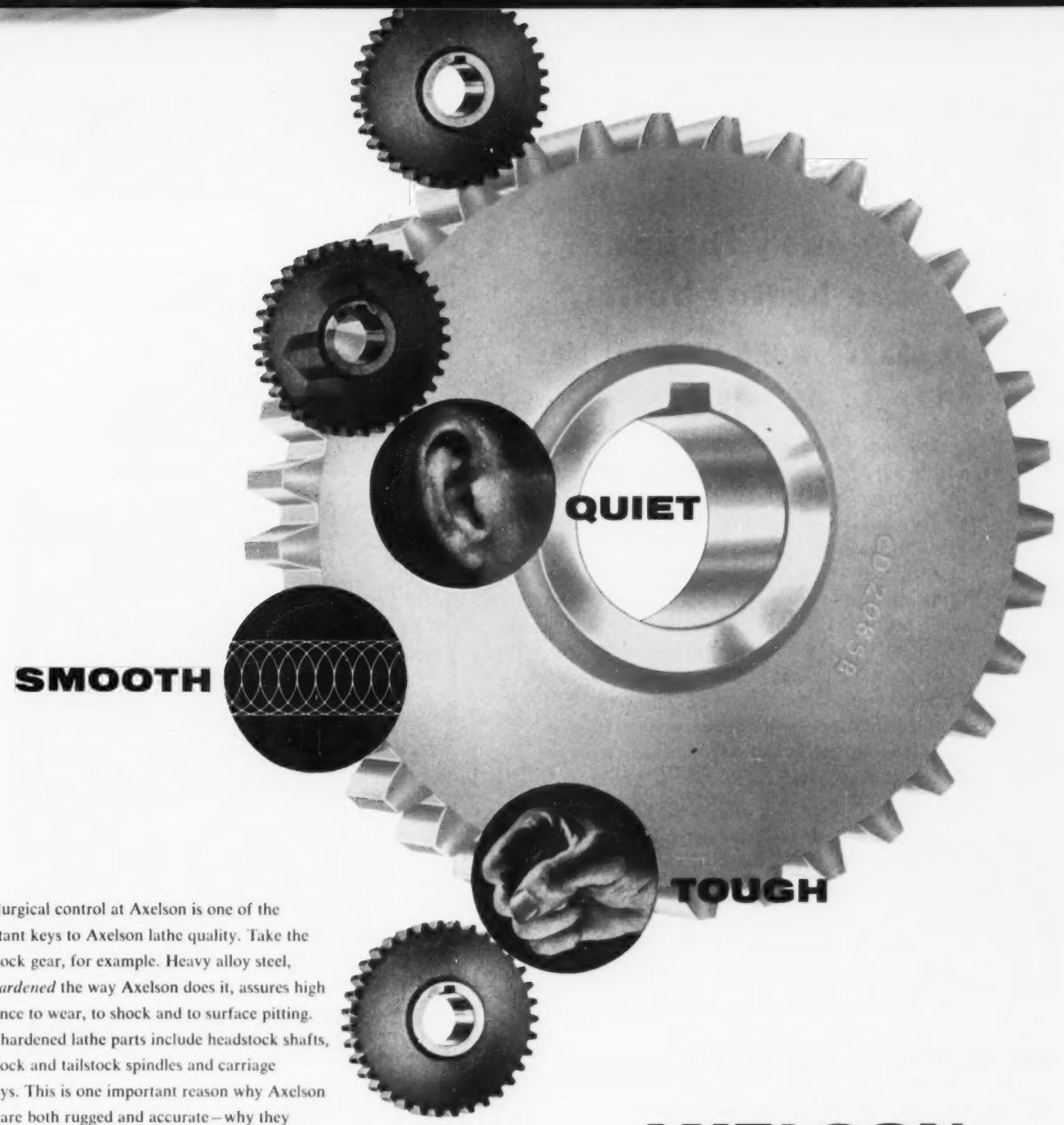
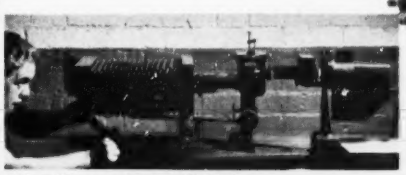


Metallurgical control at Axelson is one of the important keys to Axelson lathe quality. Take the headstock gear, for example. Heavy alloy steel, *case-hardened* the way Axelson does it, assures high resistance to wear, to shock and to surface pitting. Other hardened lathe parts include headstock shafts, headstock and tailstock spindles and carriage bedways. This is one important reason why Axelson lathes are both rugged and accurate—why they maintain their precision for long periods even under the heaviest work load. Axelson is the master of meticulous detail. Below, a few of the check points in the Metallurgy Department.

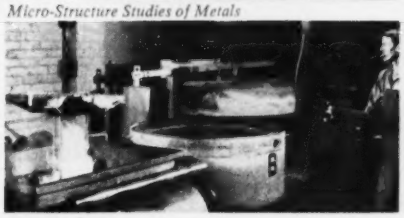
AXELSON LATHES

Hardness Testing

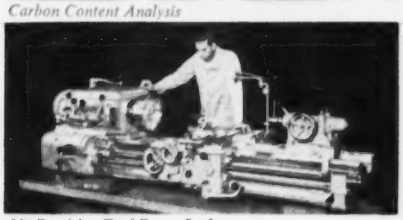


Micro-Structure Studies of Metals

Carbon Content Analysis



Case Hardening



16" Precision Tool Room Lathe

AXELSON
MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, ST. LOUIS 16, NEW YORK 7, TULSA 1

RAILROAD FREIGHT CARS • STANDARD PARTS
DAIRY & FARM EQUIPMENT • WASTE CONTAINERS
STAINLESS STEEL COOKWARE • CAR ACCESSORIES
TANKS • AGITATORS • SMOKE STACKS • DUST
COLLECTORS • COAL & ASH HOPPERS • FITTINGS & ELECTRICAL
ACCESSORIES • ORDNANCE MATERIEL • UNSHELTER RELOCATABLE
HOMES • EXPORT ONLY: LOCOMOTIVES & TRACKWORK • CARS
(MINE, ORE, CANE, INSPECTION) • UNISTRUT METAL FRAMING
WEED BURNERS • BRICK & TILE MACHINERY • CANE LOADERS

LATHES: ENGINE • TOOL ROOM • HOLLOW SPINDLE
GAP BED • PETROLEUM PUMPING EQUIPMENT:
DEEP WELL PLUNGER PUMPS • SUCKER RODS • HY-
DRAULIC PUMPING UNITS • AIRCRAFT COMPONENTS
L-48

hendey lathes are better built...

FOR LONGER, MORE ACCURATE LIFE!

And here's how it's done — Hendey starts with quality design and follows through with quality workmanship. Take the hardened and precision ground bed ways, for instance. Hendey does this differently *and better!* First, the world's most modern induction hardening equipment uniformly hardens the ways. Next, the precision machined legs and chip pan are attached to the bed (and they are never removed thereafter). Ultra precision grinding follows. Exacting checks for accuracy are then followed by electronic testing for hardness — uniform hardness — there are no soft spots in a Hendey bed — and a customer's test sheet proves it!

Add to this, quiet headstocks, the finest of lead screws, simplified, convenient controls and the ruggedness and power essential for modern precision turning.

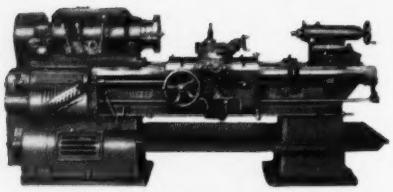
Hendey lathes maintain the Hendey tradition for quality and accuracy. And there is the *right* machine in the Hendey line to suit your precision turning requirements. Write for details.

Featuring uniformly hardened and precision ground bed ways.

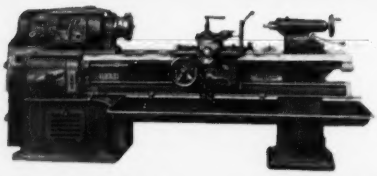
HENDEY

the Hendey machine co., inc.
torrington, conn., u.s.a.
——precision machine tools——

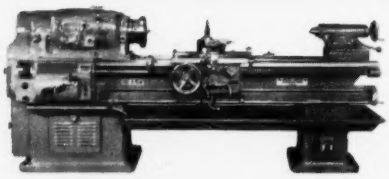
distributors in principal cities



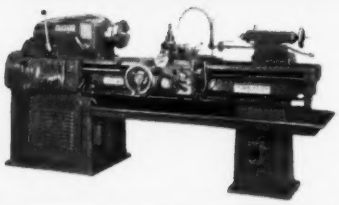
18" — 20" — 24" 12-speed Geared Head Lathes



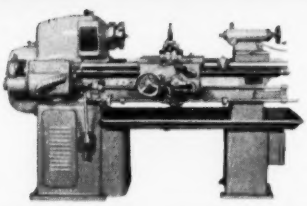
12" — 14" — 16" 18-speed Geared Head Lathes



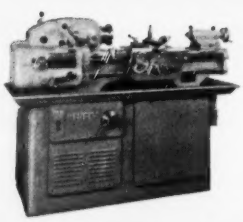
12" — 14" — 16" 12-speed Geared Head Lathes



No. 2 General Purpose Lathe

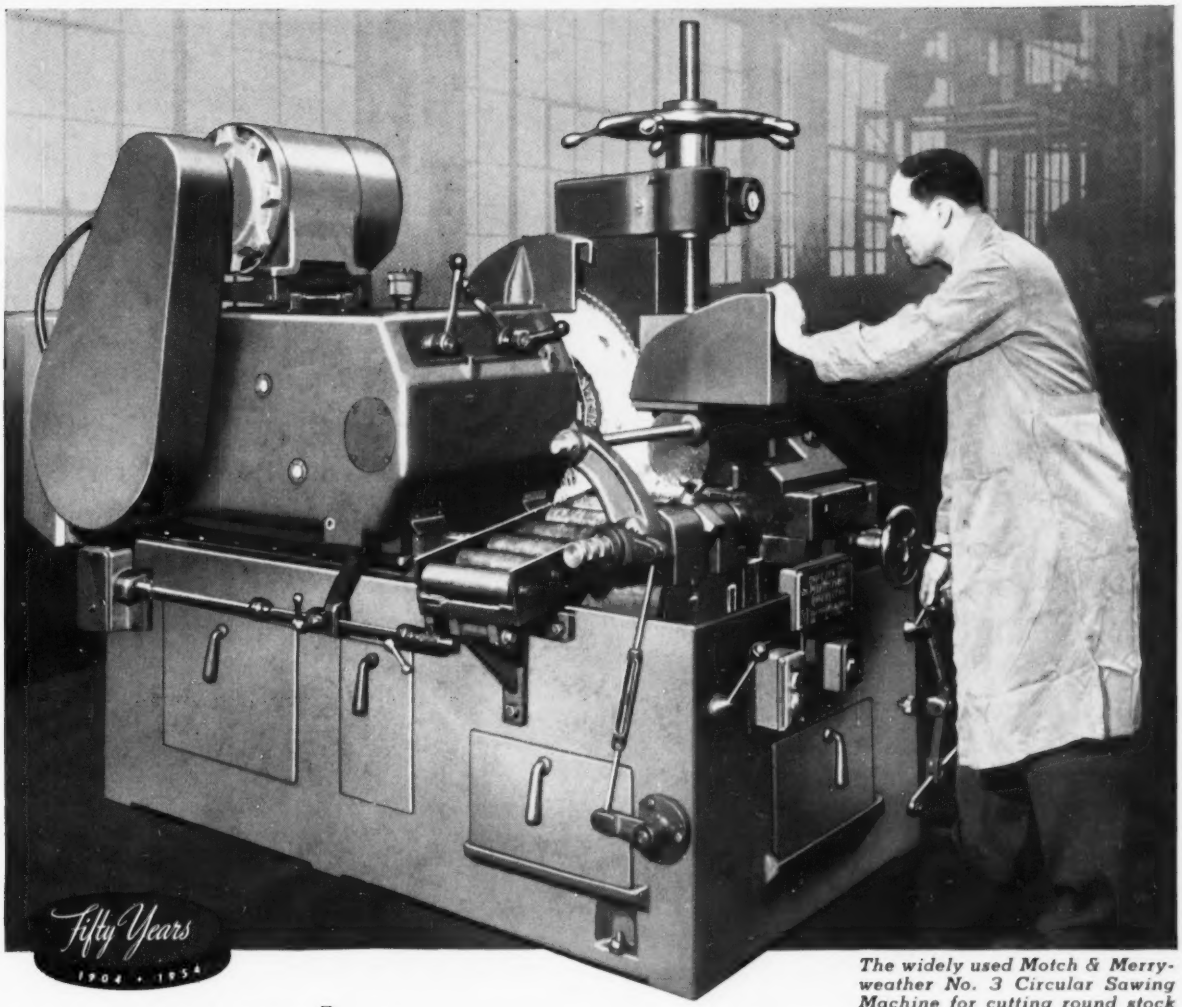


No. 1 General Purpose Lathe



9" x 24" Tool & Gage-Makers' Lathe

For more information on products advertised, use Inquiry Card, page 243



The widely used Motch & Merryweather No. 3 Circular Sawing Machine for cutting round stock up to 10" diameter.

remember...

It's the Cost per Cut that Counts!

SECURE HIGH PRODUCTION AT LOW COST

For every ferrous or non-ferrous metal, for any shape or size, for production or short runs, – study *new high* records made by Motch & Merryweather Circular Sawing Machines employing the Triple-Chip Method and available in:

A complete size range for cutting stock up to 43" diameter.

THE MOTCH & MERRYWEATHER MACHINERY CO.

CLEVELAND 13, OHIO

Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

Potash Mining — FPG Photo

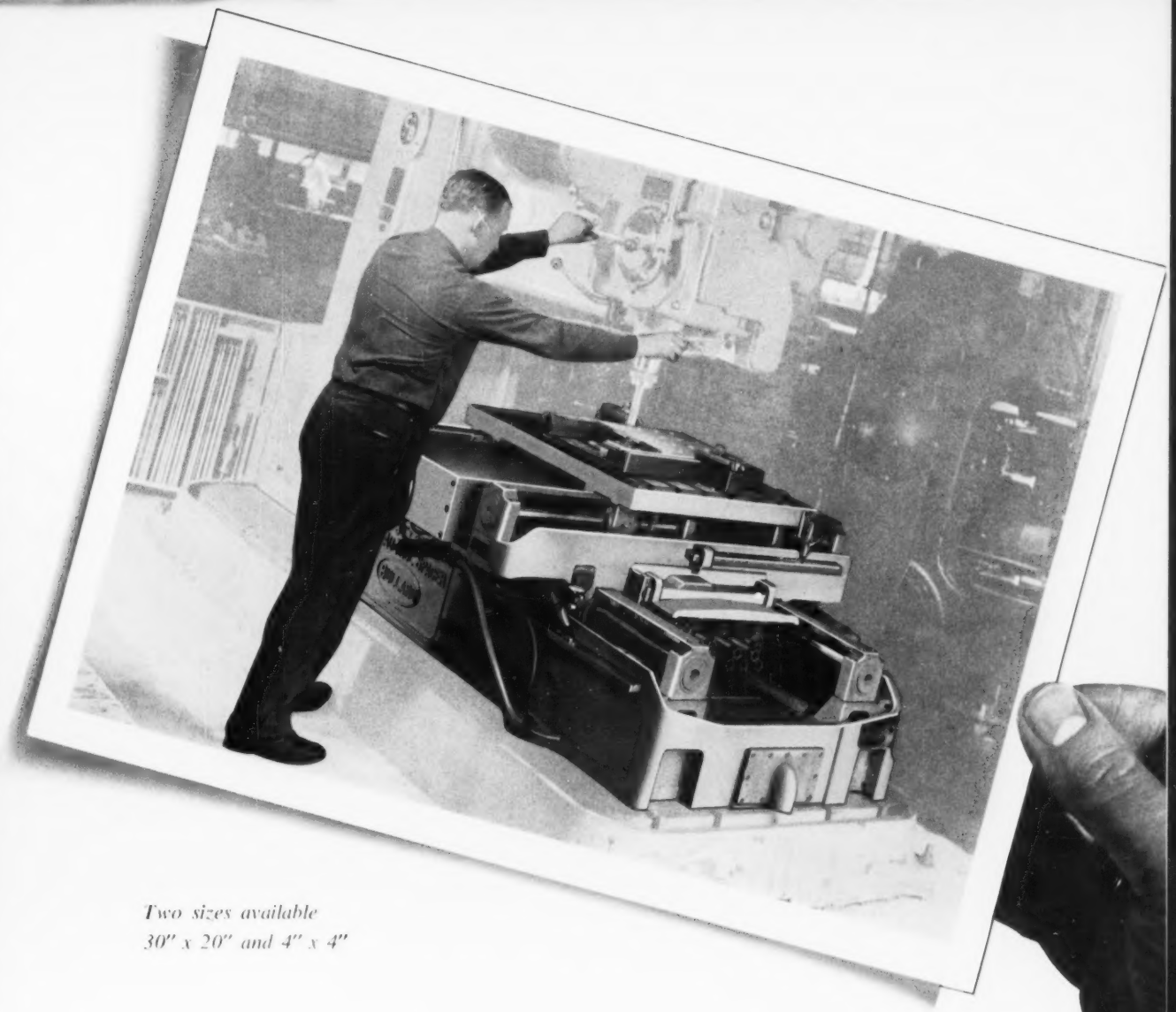
BULLARD

The Invisible Background of Industrial Progress

Potash is a well-known ingredient contained in most commercial chemical fertilizers in use today. Modern agricultural methods prescribe that, to insure farmers a good yield of higher quality produce, it is necessary to replace the loss of basic natural chemicals by means of fertilization. Potash is especially important and necessary in those areas where cotton, tobacco, corn and potatoes are the main crop.

Modern equipment, needed to mine, handle and transport such materials to the consumer at an equitable price, are basically a product of *Modern Machine Tools* — those tools essential in "The Invisible Background of Industrial Progress."

THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT

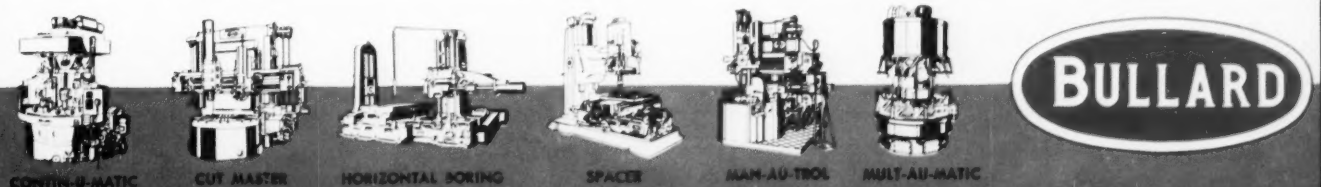


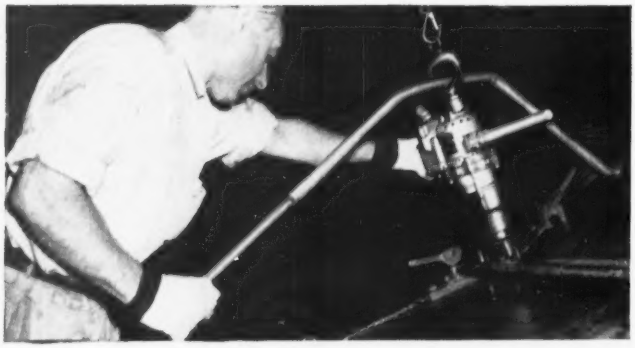
Two sizes available
30" x 20" and 4" x 4"

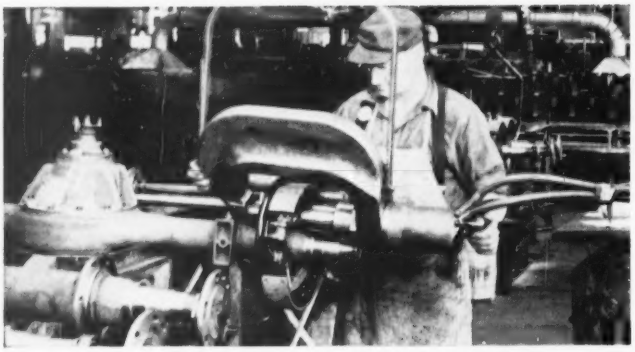
Space your costs by spacing without jigs — eliminate the cost of jig design, maintenance, storage and handling — use a Bullard Spacing Table under a fixed spindle of a Radial Drill or a Cincinnati Bickford Super Service Drill.

The advantages of accurately positioning work under a fixed spindle for any combination of drilling, boring, reaming or tapping operations are: (1) Greater speed and accuracy than is obtainable with jigs. (2) Elimination of the long period required to design and make jigs. (3) Elimination of jig bushings which are subject to continuous wear and generally require repeated replacement. (4) Accuracy is inherently maintained. (5) Simplicity of operation of the Spacer permits the use of semiskilled operators on precision work. (6) Freedom from operator fatigue, since positive locating of the work is done automatically. (7) Extreme flexibility, permitting the use of the Spacer for a large variety of both large and small work. (8) Complete visibility of the work at all times, greatly facilitates inspection.

Ask a Bullard representative to explain the many cost-saving advantages which this Spacer will afford when applied to your work or write to The Bullard Company, 286 Canfield Avenue, Bridgeport 2, Connecticut or phone 6-2511.







CP Power Tools...

First in Fastening!

There's hardly any bolt, nut, rivet or screw used on automotive production lines that can't be fastened faster and easier with a CP Power Tool.

Chicago Pneumatic's complete line of cost-cutting "tools for industry" includes: AIR TOOLS – seven different models of reversible air impact wrenches with angle head models in sizes ranging from ¼" to 1¾" bolt size; riveting hammers, squeeze riveters, one-shot guns and hydraulic compression riveters in portable and stationary models for driving hot or cold rivets up to ⅝"; ELECTRIC TOOLS – CP's portable electric tool line consists of hundreds of models and sizes of Universal, Hicycle and Super Cycle tools for drilling, reaming, screwdriving, nut running, tapping and stud driving.

Whatever your fastening needs, CP can help you do the job more economically and in less time. For more information write: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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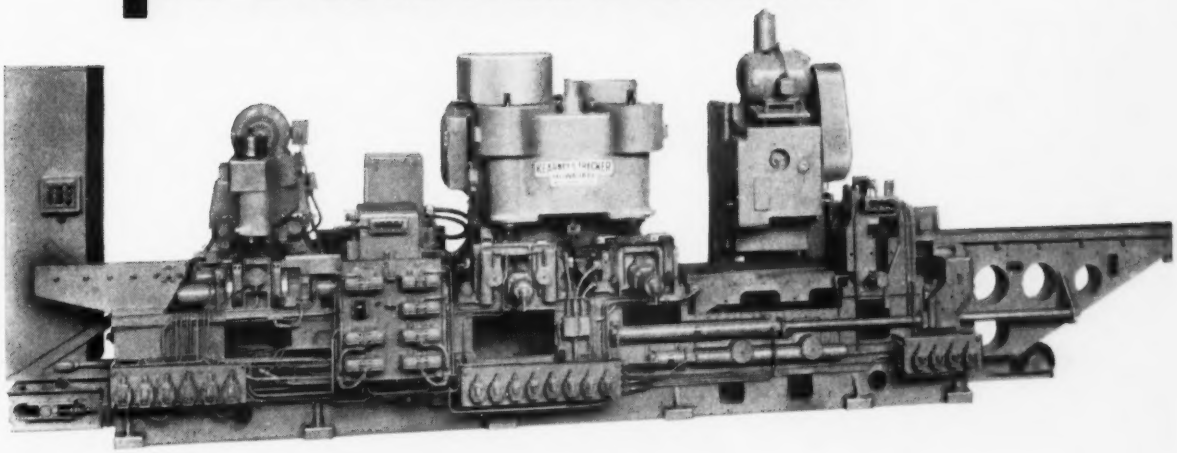
Talk about production...

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

Special Machinery Division

Builders of Precision and Production Machine Tools since 1898

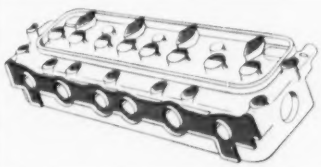


For the customer...

it put a one-at-a-time rough and finish milling job on a production basis!

THIS special seven-station traveling head transfer type milling machine solved an automotive manufacturer's problem that involved milling cylinder heads. Formerly, rough and finish milling of a six-cylinder head required six distinct machining operations and seven separate handlings. Now, by combining all the machining operations and eliminating handling... the special machine produces 62 finished pieces per hour.

TRAVELING HEADS . . . three heads — one with one spindle and two with three spindles. Full quill adjustment on all spindles. Speeds are fixed. Heads travel hydraulically on hardened and ground ways.



Color indicates machined surfaces

Capacity . . . Experience . . . Performance

Upon completion of this $5,200,000 expansion of our Special Machinery Division, we offer you (1) unmatched facilities, (2) experience based upon more than 50 years in the design and production of special machinery, and (3) performance, best recommended by our outstanding record of successfully solving many hundreds of unusual machining problems.

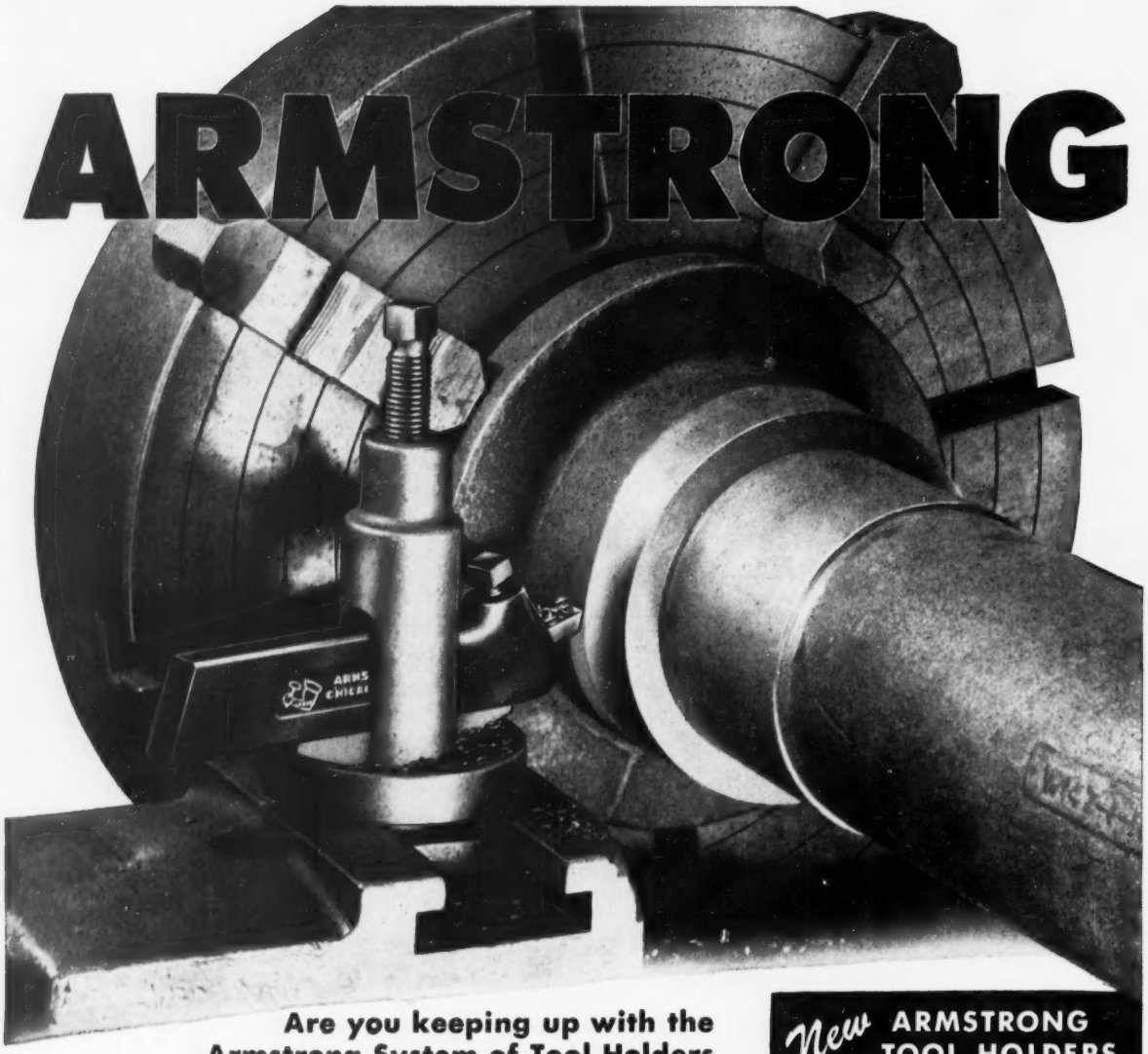
For more details on this machine . . .

ask for *Data Sheet No. 1003.* Free booklet, "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking. *Write today to* SPECIAL MACHINERY DIVISION, KEARNEY & TRECKER CORP., 6784 West National Ave., Milwaukee 14, Wisconsin.

KEARNEY & TRECKER CORP. · *Special Machinery Division*

MILWAUKEE 14, WIS., U. S. A.

ARMSTRONG



Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

WRITE FOR CATALOG

New ARMSTRONG TOOL HOLDERS
ARMSTRONG Spring Form Threading Tool Holder
ARMSTRONG Spring Cutting-off Tools
ARMSTRONG Carbide Tool Holders for Carbide-Tipped Cutters
ARMSTRONG "C-A" Tool Holders for ARMALOY (Cast-Alloy) Cutter-Bits

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

For more information on products advertised, use Inquiry Card, page 243

with TOCCO* Induction Heating

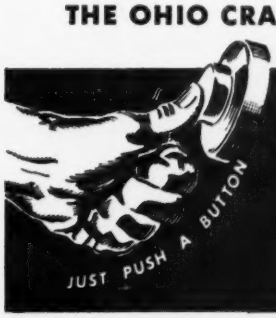
● Hardening—annealing—brazing—soldering—heating for forming or forging—if your products require any of these operations TOCCO can probably reduce your unit costs too.

COSTS DOWN 69%—Mechanics Universal Joint Division of Borg-Warner reports a 69% savings in the hardening of stub ends for propeller shafts. TOCCO'S localized hardening minimizes distortion—does away with straightening operation formerly required. With conventional heating methods splines had to be ground back to tolerance because of run-out. TOCCO also eliminates this costly operation.

PRODUCTION UP 320%—Automatic TOCCO has upped production from 35 to 112 parts per hour—over three times as fast as conventional heating method. Shafts are of C-1137 Steel, are hardened to 47—54 R.C. to a depth of 0.040". Every part is the same—one or a million—because TOCCO'S automatic heating and quenching cycles eliminate all chance for human error.

Experienced TOCCO engineers are glad to survey your plant for similar cost-cutting possibilities—no obligation of course.

THE OHIO CRANKSHAFT COMPANY



TOCCO

*Trade Mark Reg. U.S. Pat. Off.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-2, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening.

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

Monarch

Replaces a planer equipped with grinder head attachment

This Giant Thompson Grinder is one of nine working for The Monarch Machine Tool Company.

Through the years in increasing efficiency of their very fine lathes and in step with modern methods, Monarch has relied on the utility and precision of Thompson Grinders. Thompson is proud of this record of service and especially its ability to provide extreme precision grinding on this largest of all surface grinders.

INSTALLS WORLD'S LARGEST...

Surface Grinder

precision grinding lathe bedways up to 32 ft. long to a tolerance of five ten-thousandths of an inch .0005"

The precision of Thompson Way Grinders is exemplified in this giant new machine recently installed in the plant of the Monarch Machine Tool Company of Sidney, Ohio. Monarch lathes are known the world over for their extreme efficiency and accuracy, therefore, in the machining of the bedways of their longest machines they had to depend on grinding equipment that maintained exceptional accuracy over entire surfaces up to 32 feet in length. This accuracy is perfectly maintained on this Thompson Way Grinder to five ten-thousands of an inch.

Thus, this surface grinder is not only the World's largest but size for size, one of the World's most accurate machines. The overall length is 79 feet and it measures 13 feet high and 13½ feet wide. Yet in spite of its size all operations are easily controlled by a single operator automatically from the convenient suspended push button control panel. This is typical of Thompson centralized control available with all types and sizes of Thompson Grinders. It will pay you to consult Thompson Engineers in finding an economical solution to *your* problems.

Have Thompson Engineers solve your grinding problems

THE THOMPSON GRINDER COMPANY
Springfield, Ohio

Thompson Grinders

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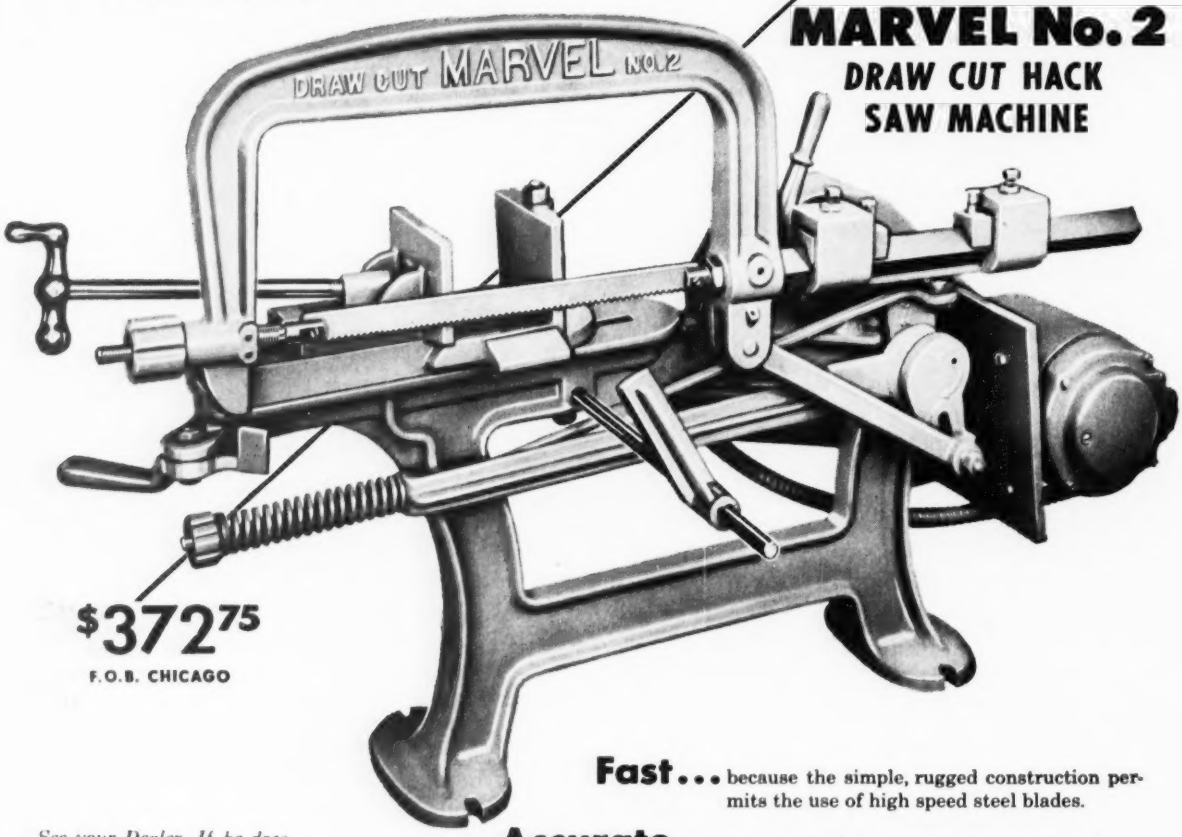
For... General-Purpose Sawing

FAST—ACCURATE—ECONOMICAL—DRY CUTTING

Capacity up to 8" round

Improved
MARVEL No. 2
DRAW CUT HACK SAW MACHINE



$372.75
F.O.B. CHICAGO

Fast... because the simple, rugged construction permits the use of high speed steel blades.

Accurate... because the improved Saw Frame with clamping type blade holders holds the blade in perfect alignment and proper tension.

Economical... because of its automatic relief on the return stroke, the blade will last and last and last.

Dry Cutting... because modern high speed steel blades will operate efficiently at 60 strokes per minute without a coolant.

See your Dealer. If he does not stock MARVEL Saws, he can get them quickly. Or simply write us for literature and delivery. When buying hack saw blades insist that your dealer furnishes genuine MARVEL High-Speed-Edge Hack Saw Blades—they are unbreakable!

MARVEL *Metal Cutting* **SAWS**
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • CHICAGO 39, ILL.

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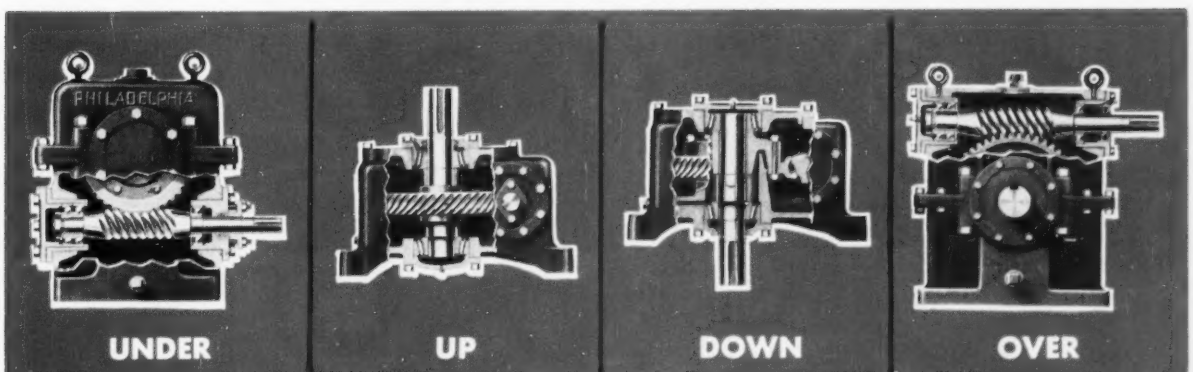
for any size and type of WORM REDUCER

specify PHILADELPHIA ...and be safe



Type "AT" Philadelphia Heavy Duty Worm Gear Reducer, with worm shaft *below* the worm gear.

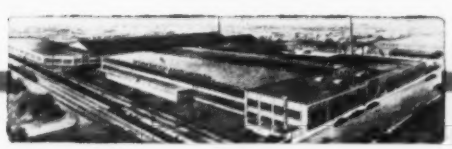
Type "UT" Heavy Duty, Vertical Worm Gear Reducer, with slow speed shaft extended upward.

Type "VT" Heavy Duty, Vertical Worm Gear Reducer, with slow speed shaft extending downward. (Note "dry-well" construction around downward shaft.)

Type "RT" Philadelphia Heavy Duty Worm Gear Reducer, with worm shaft above the worm gear

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.



Industrial Gears & Speed Reducers

LimiTorque Valve Controls

NOW- RB&W nut

IN THE LARGEST as well as the smallest sizes, RB&W turns out nuts in tremendous volume every day.

RB&W

109 YEARS MAKING STRONG

THE THINGS THAT MAKE AMERICA STRONG

Plants at: PORT CHESTER, N.Y.; CORAOPOLIS, PA.; ROCK FALLS, ILL.; LOS ANGELES, CALIF. *Additional sales offices at:* ARDMORE (PHILA.), PA.; PITTSBURGH; DETROIT; CHICAGO; DALLAS; SAN FRANCISCO. *Sales offices at:* PORTLAND, SEATTLE. *Distributors from coast to coast.*

makers are closer to your assembly line

If it's your job to buy nuts, and be concerned about delivery, you'll be glad to know that all four RB&W plants across the country are now manufacturing and stocking the famous RB&W nuts in large quantities.

No matter where you're located — on the booming West Coast, in the industrial Midwest or along the busy Atlantic seaboard — you're only a phone call away from fast, dependable delivery of the fasteners with the 109-year record of dependability.

For generations RB&W, recognized as the largest manufacturer of nuts, has pioneered in the development and manufacture of cold-formed nuts. Since 1946, RB&W has invested millions of dollars in new machinery to turn out high-quality fasteners — more than three million has been spent on nut-making facilities alone. This equipment, plus the unmatched craftsmanship of four generations of RB&W men and women, explains why RB&W continues to lead the field in the production of top-quality nuts.

3.41

ONE OF THE BATTERIES of RB&W nut formers which insure complete uniformity of every RB&W nut sold.

MAJOR AUTOMOBILE MANUFACTURER DRILLS FOR OIL . . .

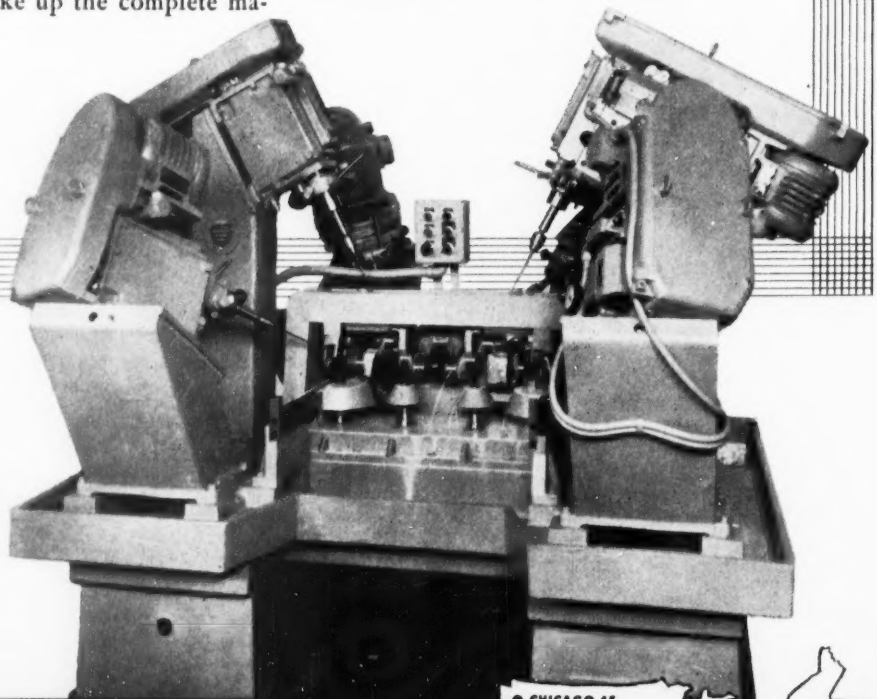
with 32 LELAND-GIFFORD Crankshaft Drilling Machines

This Leland-Gifford Drilling Machine practically takes a crankshaft out of the operator's hands, drills six perfect oil holes in it, and then hands it back.

Actually, the operator slides the crankshaft in on rails. The Leland-Gifford Machine then positions and clamps it, turns on the coolant, drills the ¼" x 5½" holes, then unclamps.

Six standard self-contained deep hole drilling units make up the complete machine. Each unit has its own feed rate, overload protection (will back out if the drill gets dull) and source of pressure. Individual units may be removed and replaced with no pipes to disconnect.

No better endorsement of Leland-Gifford Crankshaft Drilling Machines could be made than to report that the same manufacturer has just ordered additional units.



Leland-Gifford offers a complete line of modern motor spindle drilling machines plus unsurpassed engineering skill and facilities for adapting standard machines to meet special drilling needs. A Leland-Gifford field engineer can show you how to improve production and lower costs with Leland-Gifford methods.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

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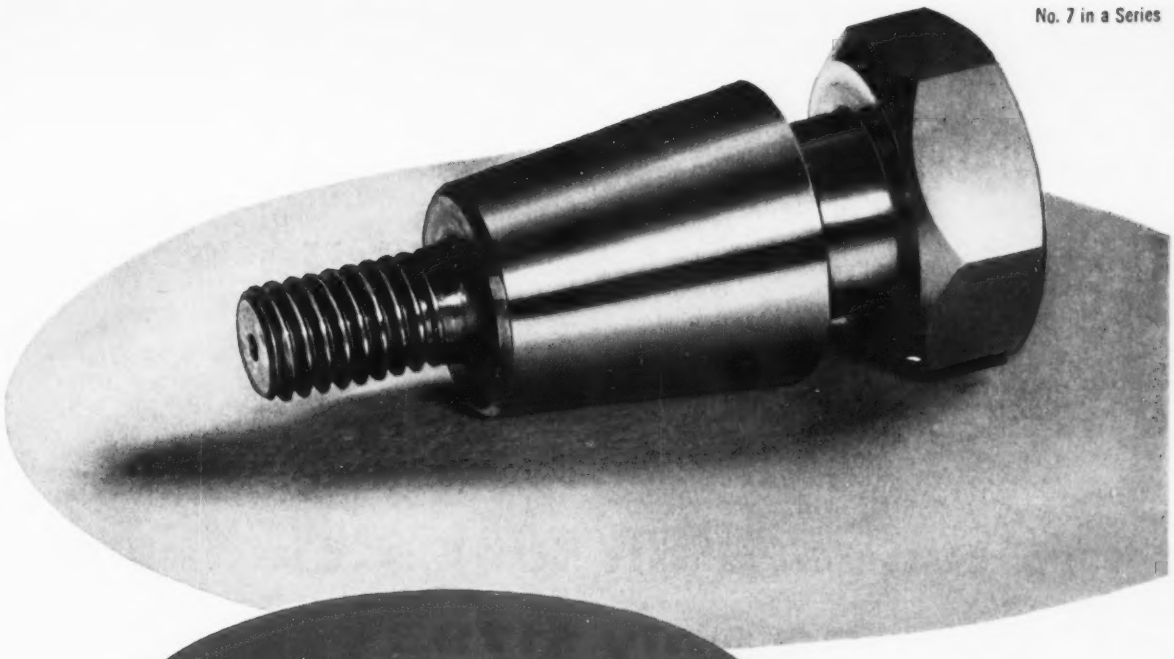
No. 7 in a Series



carbide service available

Where conditions are favorable, 100% carbide tool-ups on "Automatics" make HSS tools appear as obsolete as ancient tools of carbon steel.

In determining the "favorable" conditions, the Conomatic Carbide Development is of real service to the "Automatic" user. Without risk of production loss or obligation of machine purchase, he gets an eye-witness demonstration of the profit possibilities of 100% carbide tooling to his own work.

data for comparison

Part	Petcock Center
Machine	1⅜" Six Conomatic
Tools	100% Carbide Tipped
Material	X-1112
Stock Size	1" Hexagon
R.P.M.	1562
Time	8 seconds

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

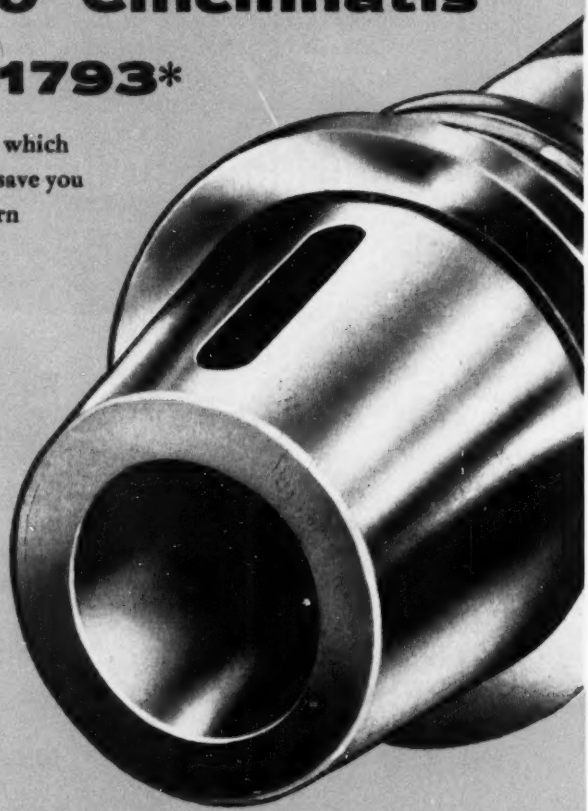
This High Quality Lathe Spindle

It's made from hardened alloy steel. It's extra long, with tapered key drive. Three antifriction roller bearings give it sturdy precision and rigidity. The hole is exceptionally large. It is as fine and durable as any lathe spindle, regardless of cost.

Is Standard on 10" Cincinnatis costing only $1793*

Invest your lathe dollars wisely in a machine which can be busy 100% of the time. "Cincinnatis" save you hundreds of dollars in first cost . . . and return your investment faster. They're the only low-priced lathes with high-priced features.

*10" x 24" std. drive, FOB factory. Price subject to change without notice.



center on . . .

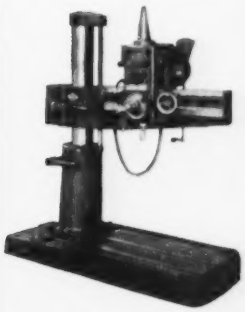
cincinnati lathes and drills

1. All-geared headstock
2. 12 spindle speeds in geometric progression
3. Direct-reading speed-shifting mechanism
4. Large spindle mounted in three antifriction bearings
5. Flame-hardened gears in headstock, quick change box and apron
6. Cabinet legs with built-in leveling jacks
7. Enclosed quick change box with lead-screw reverse
8. One shot lubrication of ways
9. Ground ways (flame hardened at extra cost)
10. Tray-Tops on headstock and tailstock
11. Double-walled apron with automatic lubrication
12. Fully enclosed electrical panel, built-in disconnect, transformer, motor and controls (all standard equipment)

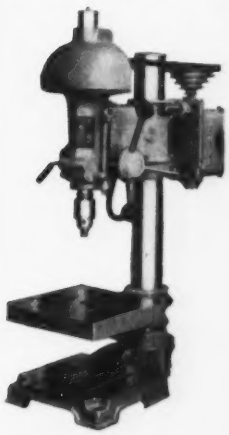
Cincinnati Tray-Tops: engine, toolroom, gap bed 10", 12½", 15", 18" swing.
Cincinnati Model LT: engine, gap bed 16", 18", 20", 24" swing.

For complete catalogs, prices and name of your local dealer, write on company letterhead to Cincinnati Lathe & Tool Co., 3266 Disney, Cincinnati 9, Ohio.

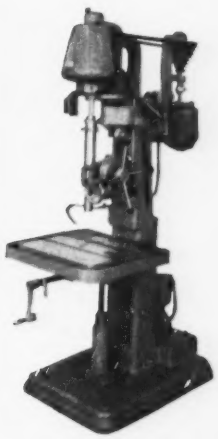
There is also a complete line of Cincinnati bench, floor and radial drilling machines



3' 7" Radial Drill



16" Royal Bench Drill



21" Sliding Head Box Column Floor Drill

Need small bearings that can carry heavy loads?

here's how manufacturers of materials handling equipment get them with NEEDLE BEARINGS

Leading manufacturers of lift trucks, industrial trolleys and conveyors, cranes, hoists and other types of materials handling equipment specify Torrington Needle Bearings because of their high capacity and their compactness.

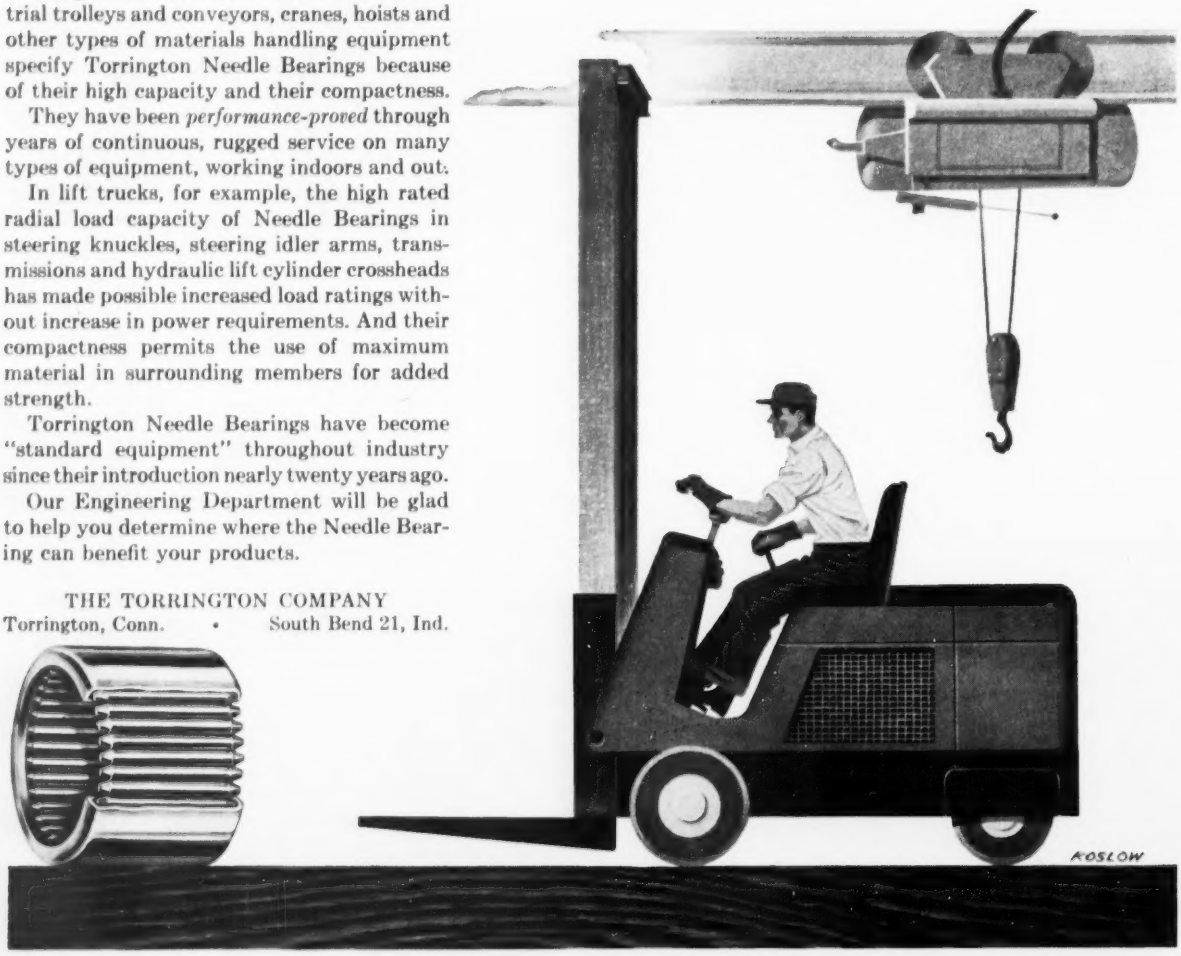
They have been *performance-proved* through years of continuous, rugged service on many types of equipment, working indoors and out.

In lift trucks, for example, the high rated radial load capacity of Needle Bearings in steering knuckles, steering idler arms, transmissions and hydraulic lift cylinder crossheads has made possible increased load ratings without increase in power requirements. And their compactness permits the use of maximum material in surrounding members for added strength.

Torrington Needle Bearings have become "standard equipment" throughout industry since their introduction nearly twenty years ago.

Our Engineering Department will be glad to help you determine where the Needle Bearing can benefit your products.

THE TORRINGTON COMPANY
Torrington, Conn. • South Bend 21, Ind.



TORRINGTON *NEEDLE* **BEARINGS**

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

Trade-marks of leading materials handling equipment manufacturers who use Needle Bearings in their products.

For more information on products advertised, use Inquiry Card, page 243

"AMERICANS" WORKING FOR NORDBERG

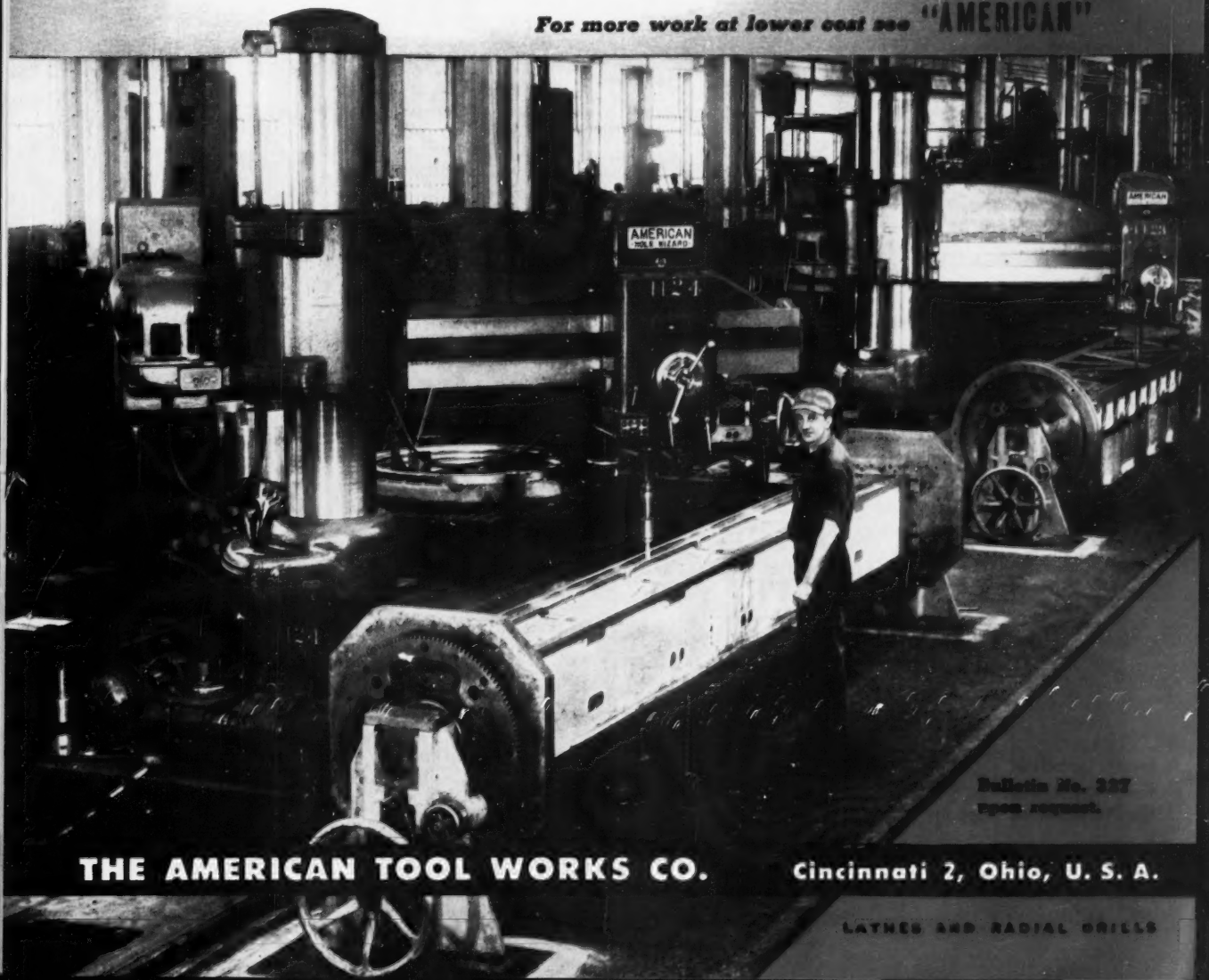
helping to profitably produce the quality products for which Nordberg Manufacturing Company of Milwaukee, Wisconsin is known the world over.

These "AMERICAN" Track Type Hole Wizard Radials mounted on mobile bases speed up drilling, tapping and boring operations in long, heavy work pieces by bringing the tool to the work rather than moving the work to the tool.

The work pieces are mounted in elaborate trunnion jig fixtures so different work planes may quickly be presented to the tool and a high degree of accuracy maintained.

The quality of Nordberg products is universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to it.

For more work at lower cost see "AMERICAN"



Bulletin No. 327 upon request.

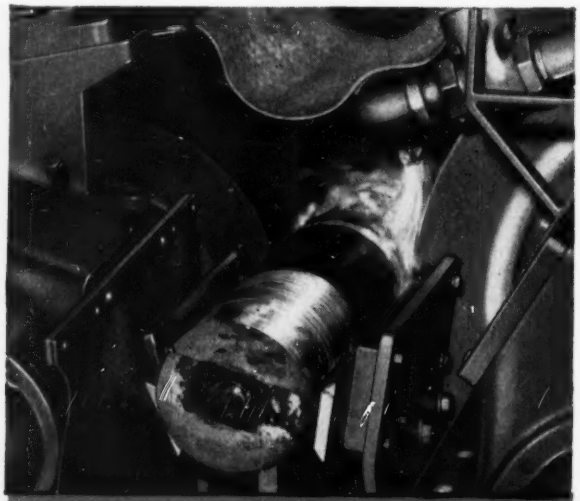
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Here's the grinding wheel that will ABSOLUTELY solve it!

Are you in a predicament over a tough centerless grinding production problem? CINCINNATI Grinding Wheels can get you off that hot spot because they're made to team-up with centerless grinders.

And with a Cincinnati Milling-trained machinist on the job to help you get the most out of



The Thermador Electrical Manufacturing Co., Los Angeles, had tough problem in grinding 4.2 mortar shells. Chatter and burning caused erratic production. For solution, see Case History.

CINCINNATI Grinding Wheels, you can count on the *right answer*—FAST! Here's why:

1 CINCINNATI Grinding Wheels are used by—and *developed* by—Cincinnati Milling, which has done more research, had more experience and made more centerless grinders than any other organization in the world.

2 Using CINCINNATI Wheels, we've solved hundreds of centerless grinding problems—such as production, roundness, taper, sizing, stock removal, finish and accuracy.

3 CINCINNATI Grinding Wheels represent 25 years of Cincinnati Milling research and practical experience based on an entirely new approach to grinding wheels—the development of the grinding wheel as a true cutting tool.

We are so confident—*so absolutely sure*—that CINCINNATI Grinding Wheels can help solve your tough centerless production problem that we make this *unconditional offer:* either you must be completely satisfied, or we will make no charge for the CINCINNATI Grinding Wheel used.

So contact us at once. We'll send one of our expert machinists—men who are Cincinnati Milling-trained and know grinding and grinding machines as well as grinding wheels. He can show you how to get the most out of CINCINNATI Grinding Wheels and help you solve that tough centerless production problem. There is no charge for his service. Write, wire or phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CASE HISTORY No. 217

How CINCINNATI GRINDING WHEELS Solved Tough Centerless Production Problem

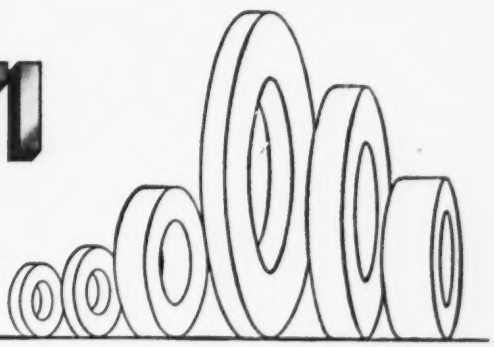
The job	Thru feed grind 4.2 mortar shells. Material - resistance welded steel tubing SAE 1030-1050 normalized to 75,000 p.s.i. Stock removal - .010"-.015". Tolerances - size .003, finish 75 r.m.s.
The machine	Cincinnati No. 2 Centerless
The problem	Erratic production caused by chatter and burning.
The solution	A Cincinnati Milling machinist, in collaboration with the customer, Thermador Electrical Manufacturing Company of Los Angeles, worked out the solution — on the job — using a Cincinnati Wheel from local stock. The wheel prescribed was a Cincinnati 2A60-K5-VN, 20" x 6" x 12". In addition to providing the correct wheel, the Cincinnati expert also recommended changing the type dresser, and adjusted the blade angle, work speed and feed rate. Results — all troubles were eliminated and production was not only stabilized but increased!

CINCINNATI GRINDING WHEELS are manufactured in this new, completely modern plant.

CINCINNATI
Grinding Wheels

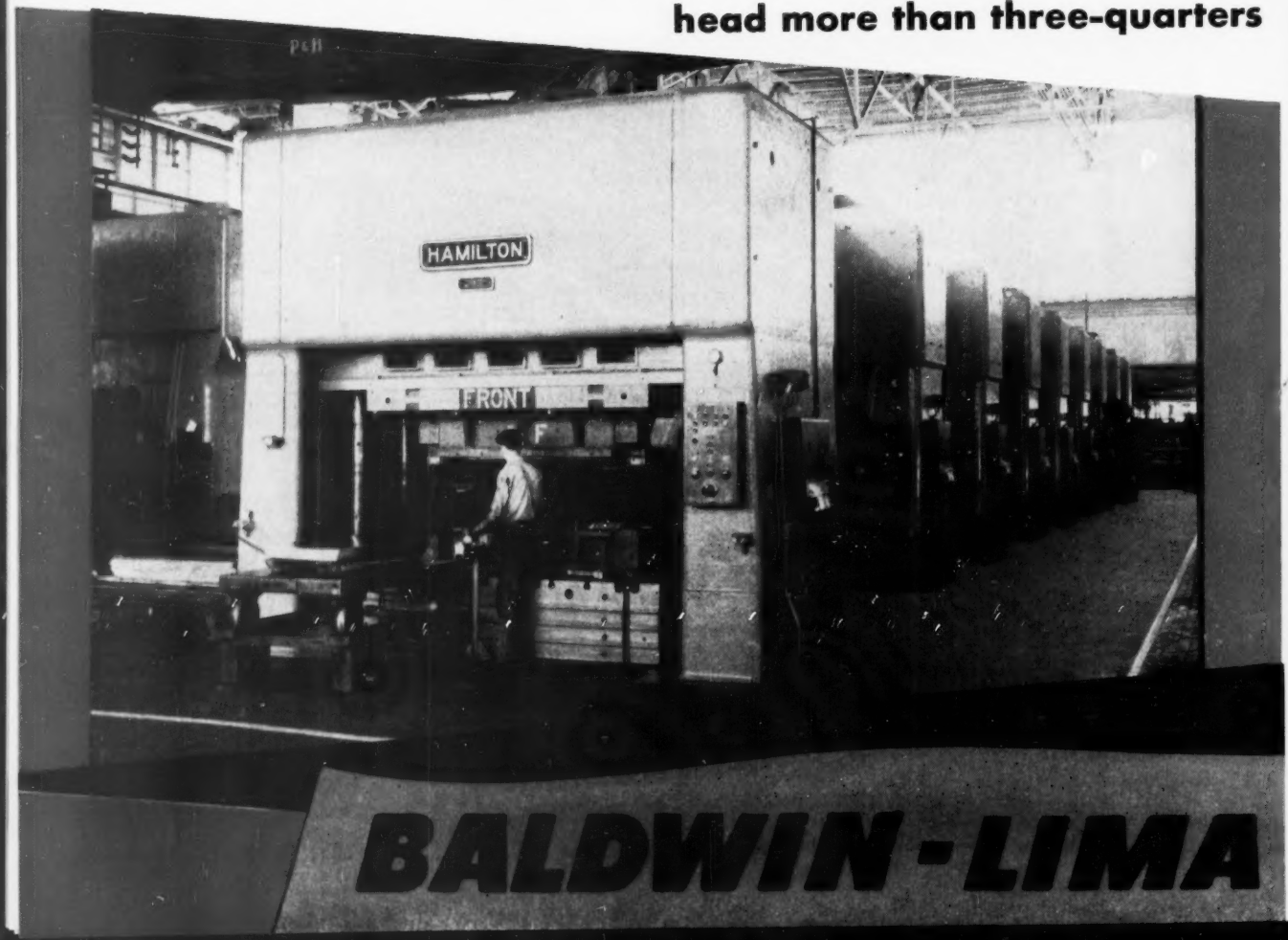
THE CINCINNATI MILLING MACHINE CO.

Cincinnati 9, Ohio



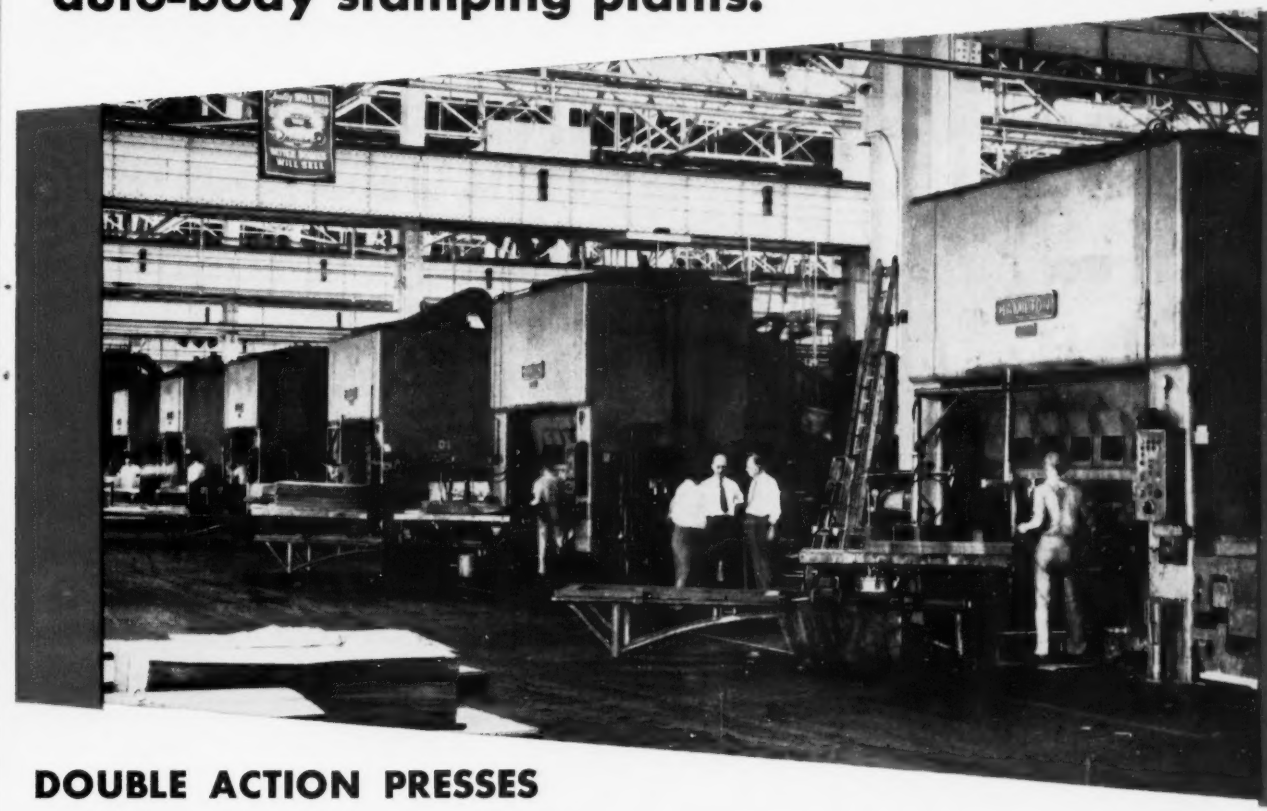
HAMILTON PRESSES in the largest

HAMILTON TRIPLE and
head more than three-quarters



BALDWIN-LIMA

auto-body stamping plants.



DOUBLE ACTION PRESSES
of the master production lines.

HAMILTON PRESSES

HAMILTON PRESS DIVISION
CURTIS BUILDING, DETROIT 2, MICHIGAN
Branch Offices: NEW YORK, CHICAGO
Factory: HAMILTON, OHIO

BALDWIN
BLH
LIMA-HAMILTON

-HAMILTON

Frauenthal Grinders

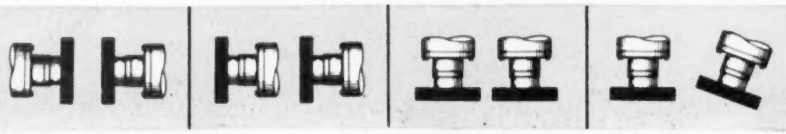
accurate within two-hundred

MILLIONTHS!

✓ **on production jobs involving ultra-precise grinding of large related surfaces**

✓ **by vertical positioning of large work, thus making practical tolerances never before considered possible**

Diagrams show some of the many spindle position combinations possible for simultaneous inside, outside or face grinding of related surfaces



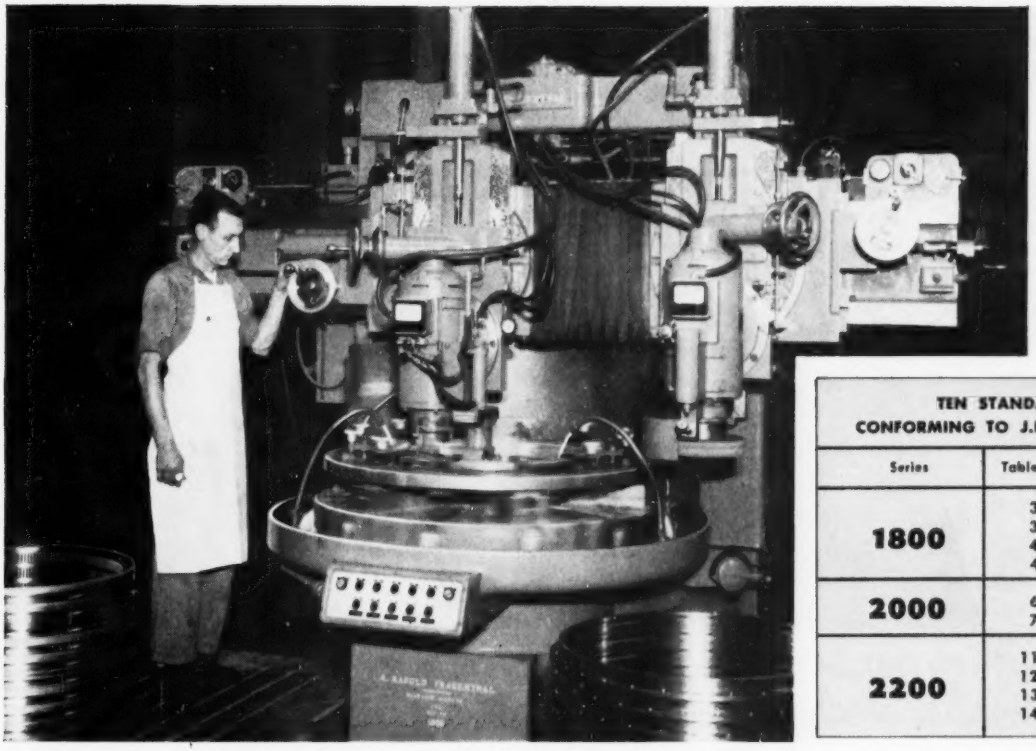


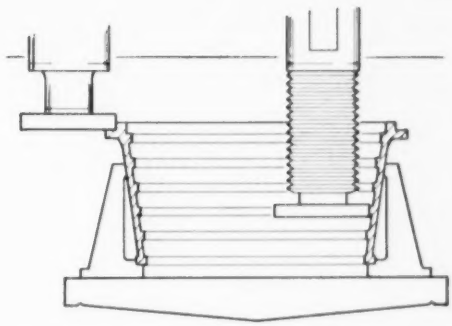
Photo shows 1800 Series Grinder finishing ultra-precision bearings.

TEN STANDARD SIZES CONFORMING TO J.I.C. SPECIFICATIONS		
Series	Table Sizes	Maximum Swing
1800	30″ 36″ 42″ 48″	60″ 60″ 60″ 60″
2000	60″ 72″	72″ 88″
2200	110″ 120″ 130″ 140″	120″ 130″ 140″ 150″

NOW — on all your toolroom or production grinding, even on unusually large work—you can get the advantages of Frauenthal "millionths-of-an-inch" precision at no more than it would cost you for less accurate grinding.

With a Frauenthal Grinder, you can easily hold tolerances within two tenths . . . to dimensions best expressed in millionths of an inch . . . on unusually large work where it was previously impossible to approach this kind of accuracy. This capacity . . . and the ability to maintain exacting tolerances on production schedules . . . is primarily due to two factors: (1) the Frauenthal vertical grinding principle, and (2) the ultra-precision with which each grinder component is built.

With a single setup, Frauenthal grinders allow you to simultaneously grind related *bores* and *O.D's. round* and *straight,* to uniform accuracy within two hundred millionths! Furthermore you can precision-grind related *faces, flat* and *square,* or *perpendicular,* or at *angles,* to such accuracies.



Here's another typical precision job of simultaneous grinding by a Frauenthal

Sketch shows two surfaces of a jet engine diffuser case being ground at the same time to produce maximum precision for concentricity and parallelism. Absolute interchangeability of parts is assured.

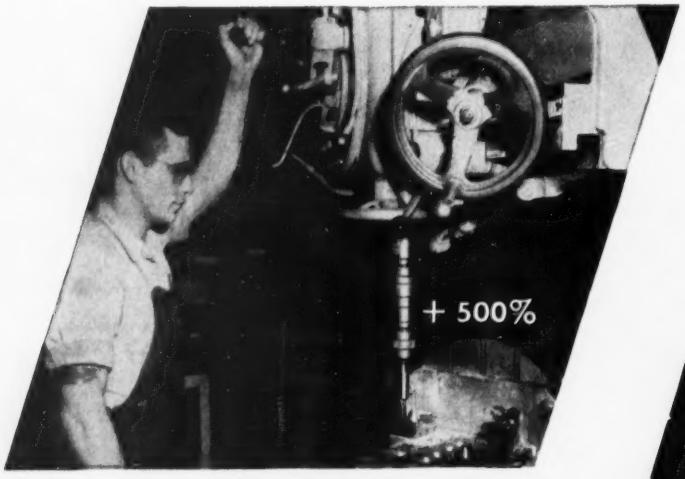
What are your grinding problems?

Tell us what you aim to do . . . and our engineers will gladly cooperate in helping you find the most efficient grinding procedures. Write for informative bulletin.

Frauenthal MULTIPLE-HEAD SUPER-PRECISION VERTICAL Grinders

Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN

Announcing new tap driver ..



SCULLY-JONES
Patent Pending
Scully-Jones non-reversing Safe-Torque Drivers may be used in any machine having a reversing spindle!

New Scully-Jones Safe-Torque Driver reduces tap breakage 400-500%

Here's the newest, most promising development in tapping from Scully-Jones! It's a completely new application of the roller-drive principle for tap drivers .... proved on the production line at Caterpillar Tractor Co. Tap breakage, scrap and production losses resulting from downtime may now be minimized. Adverse machining conditions such as hard spots, poor chip removal, inadequate cooling or lubrication, and improper sharpening of taps are brought under new, positive control. Overrunning roller drive releases instantly when torque reaches danger point ... *without* friction or wear ... *with* free-wheeling action! Here's one report from "Caterpillar" (job illustrated above): "production up 5% ... improved finish and accuracy ... 25% cost reduction ... 10-12% manpower saving ... *tap breakage reduced 500%*." For details and delivery, contact your Scully-Jones representative or stocking distributor.

Positive release • positive reset • adjustable torque • small diameter • roller drive • free-wheeling action • no wear proved safety features • maximum speeds

BRINGS TAPPING UP TO MODERN MACHINING METHODS

Reduces tap breakage—Releases instantly and completely when torque reaches danger point. Prevents use of dull taps.

Boosts production—Builds operator's confidence in tool. Permits tapping at full speed to full depth. Operates at any speed taps can take.

Helps control quality—Releases when tap is too dull. No objectionable, overriding motion. Helps produce uniform, accurate threads.

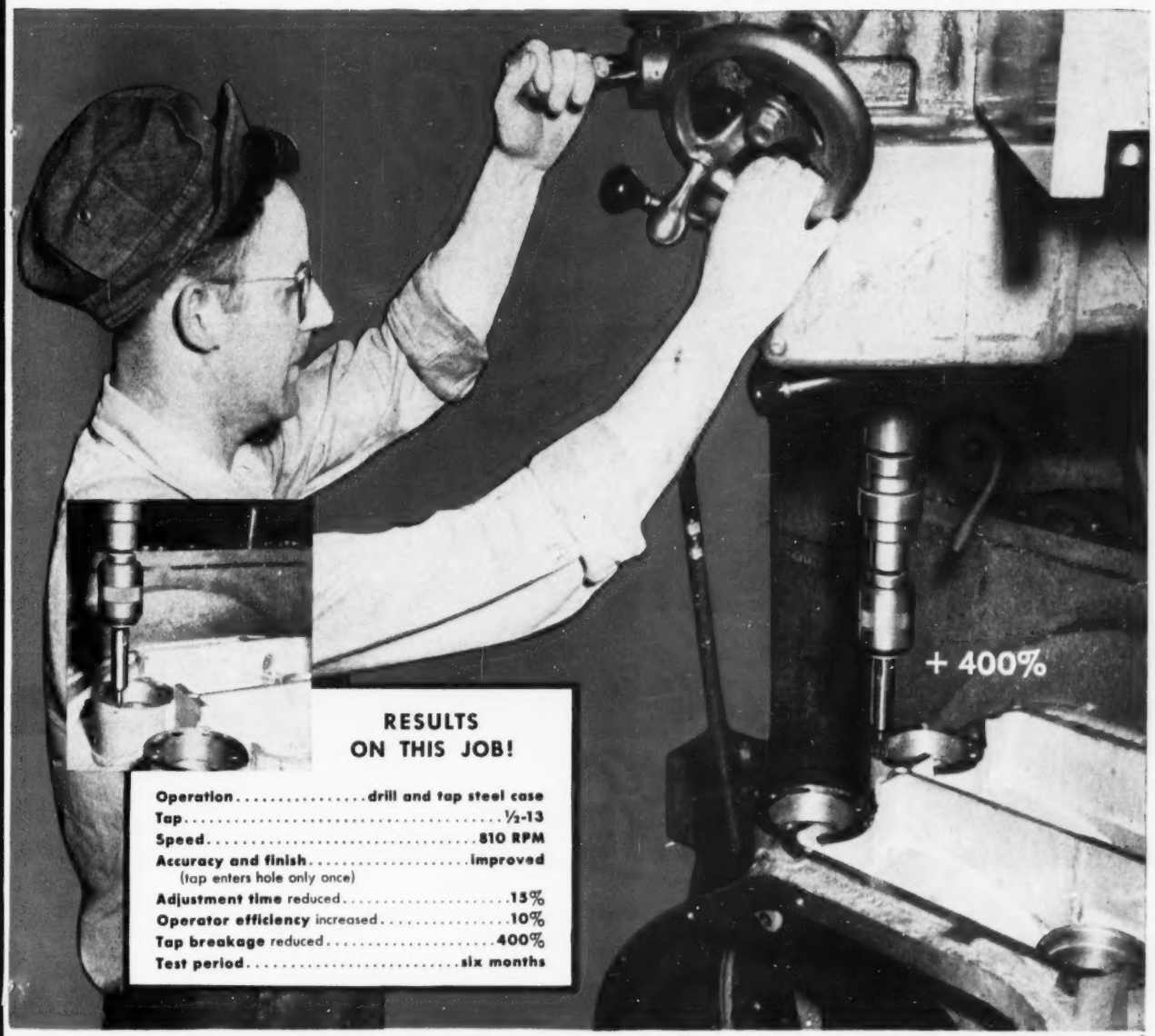
Keeps tooling costs low—Five settings provided to adjust torque for various jobs. May be used with standard Scully-Jones Quick-Change Chucks, Turret Tool Holders, Sleeves, Adjustable Adapters, and Tap Chucks.

Saves manpower and material—Dependable control minimizes scrap. Eliminates rework on piece-parts. Reduces downtime.

Makes tapping more versatile—With stop-nut on tap, number of threads may be controlled automatically. Compression spring provides a cushion for bottom-tapping in blind holes without slow-down.

Proved dependability—No overheating or change in torque, even at high overrunning speeds. Human element minimized ... torque setting not easily changed by operator.

...job-proved at "CATERPILLAR"!



RESULTS ON THIS JOB!

Operation	**drill and tap steel case**
Tap	**½-13**
Speed	**810 RPM**
Accuracy and finish (tap enters hole only once)	**improved**
Adjustment time reduced	**15%**
Operator efficiency increased	**10%**
Tap breakage reduced	**400%**
Test period	**six months**

SCULLY JONES

Precision Holding

FOR HOLDING PRECISION

Scully-Jones and Company, 1906 South Rockwell Street, Chicago 8, Illinois

For more information on products advertised, use Inquiry Card, page 243

NEW CATALOG!

Write for Bulletin 20-50. Gives you important features, specifications, and field-test reports on Safe-Torque Drivers.

Gentlemen: I'm interested in learning more about Scully-Jones Safe-Torque Tap Drivers . . .

☐ Please send Bulletin 20-50

☐ Have representative call

Name_____

Company_____

Address_____

City_____ State_____

NEW
TAFT-PEIRCE *Superpower*
PERMANENT
MAGNET CHUCK

PROVIDES GREATER WORKING SURFACE

An entirely new design, the Taft-Peirce Superpower Permanent Magnet Chuck has 15 to 20% less height than other makes. Provides more clearance between wheel and chuck.

Stronger, yet flexible, too. Just push or pull lever to vary power anywhere from maximum to minimum. Permanently magnetized, power won't fade with use.

Additional poles provide greater working surface.

Ideal for surface grinders, these T-P Chucks are also effective on light millers, planers, shapers. The portable smaller sizes speed hand-finishing, burring, scraping, polishing, inspection operations.

Available in range of sizes. Write for bulletin, today.

T P *T-P means Top Precision*

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND

For more information on products advertised, use Inquiry Card, page 243

YOURS?

Probably not. But if they were, and if you installed them in a product, and kept a record of them, you'd find them typical of "Double Diamond" Gears: *long* on the kind of performance that saves you money, saves you headaches, and keeps your customers pleased.

Does service of this kind interest you?

DOUBLE DIAMOND GEARS

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

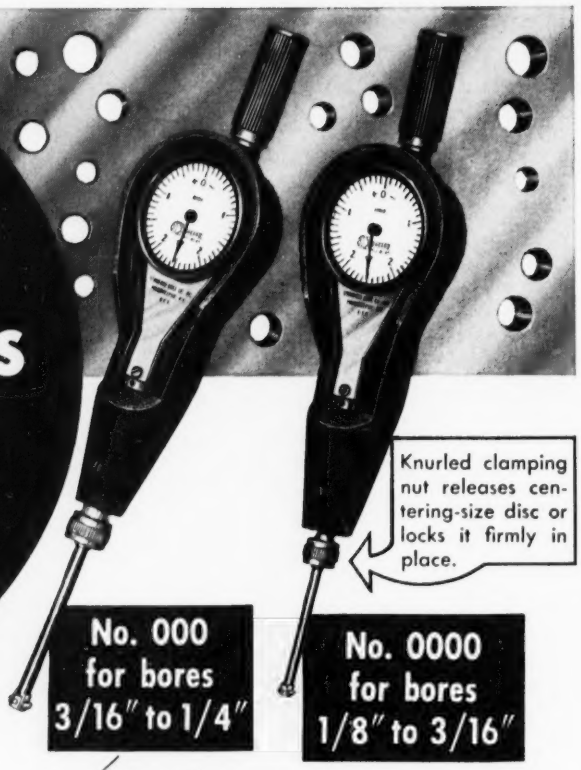
ESTABLISHED IN 1914

RICHMOND, INDIANA

NOW!—DOWN TO 1/8"

Two New Dial Bore Gages for measuring 1/8" and 3/16" bores

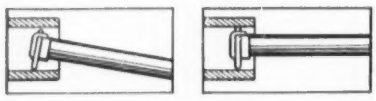
Patent Applied For


Knurled clamping nut releases centering-size disc or locks it firmly in place.
No. 000 for bores 3/16" to 1/4"
No. 0000 for bores 1/8" to 3/16"

These two new STANDARD developments extend the effectiveness of STANDARD Dial Bore Gages to quick, accurate, quantitative inspection of bores down to as small as ⅛" diameter. They utilize the "centering-size disc" principle, tested-in-use with similar but slightly larger gages.

* Hold settings positively
* Give reliable repeat readings
* Sapphire tipped gaging plungers and chrome-plated centering-size disc insure long gaging life
* High visibility dial graduations of .0001 are easy to read
* "Capstan" adjusting disc facilitates adjustment when zeroing instrument.

EASE OF OPERATION



Gage is entered at an angle to allow extended plunger to clear the bore, then rocked to cause plunger to pass a square position while noting minimum reading on the indicator.

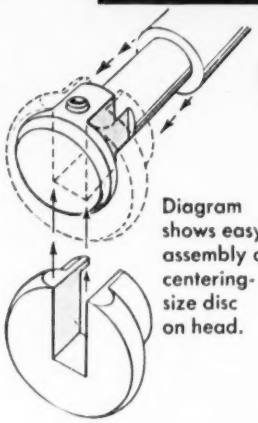


Diagram shows easy assembly of centering-size disc on head.

EASY "SIZE CONVERSION"

Conversion to various sizes in the over-all range of the gage is accomplished by the quick interchange of centering-size discs on the same head simply by turning the knurled clamping nut. Positive interlocking action insures holding set dimension. Centering-size discs are furnished to fit bore dimensions specified by the user, or in complete sets.

AVAILABLE AS ONE-DIMENSION OR FULL-RANGE GAGE

When either gage is supplied with set of discs, any dimension within its over-all range can be measured with a tolerance up to plus or minus .002".

STANDARD Dial Bore Gages now in 10 sizes covering range from ⅛" to 16"

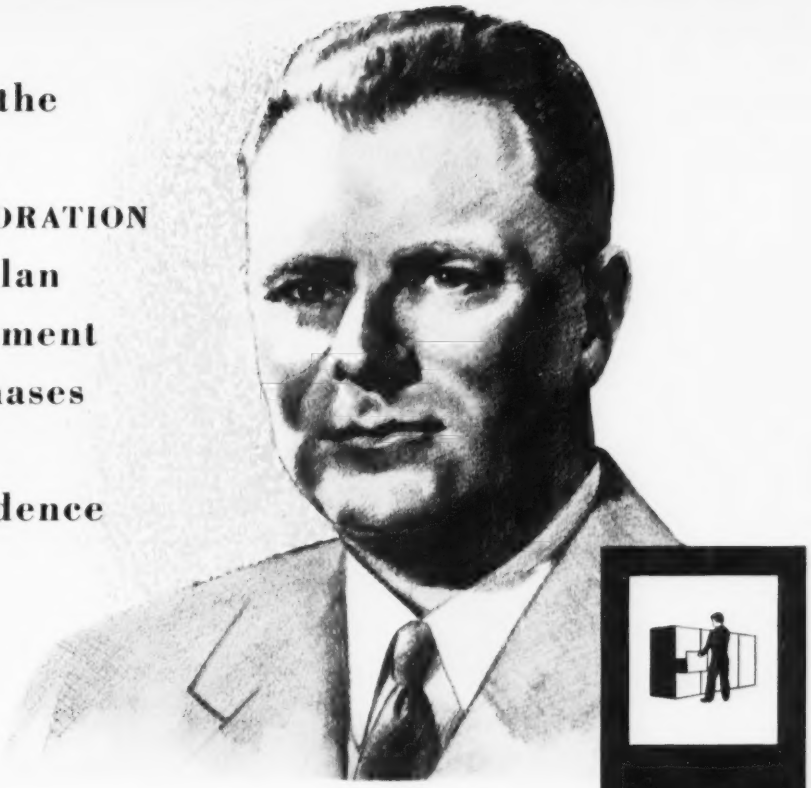
Write for full details

STANDARD Gage Co., Inc.

POUGHKEEPSIE, N.Y.

For more information on products advertised, use Inquiry Card, page 243

Why the FALK CORPORATION can plan equipment purchases with confidence



"At the Falk Corporation, we use the M.A.P.I. formula in analyzing equipment for possible replacement. The replacement problems generally divide themselves into two groups. In the first group we find equipment which can no longer maintain quality standards and must be rebuilt or replaced. The second group consists of equipment which is suspected of being obsolete. For problems in the first group, a side by side analysis of the cost of replacing or rebuilding enables us to make the most economical decision. In the second group, the new equipment must show a large enough operating cost advantage to offset the capital cost of purchasing it.

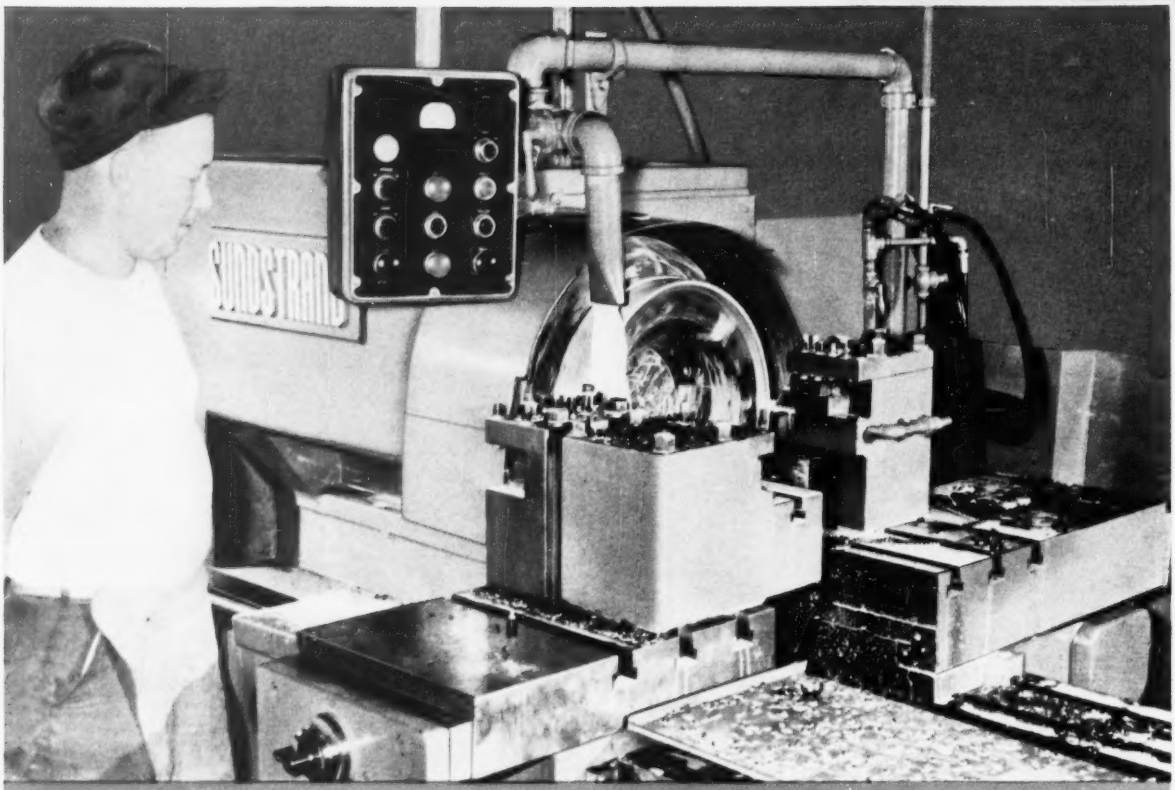
Application of the formula by the Methods Department is made possible by the cooperation of all other departments who supply the information necessary for the analysis. The file of all equipment analyzed is available to the Capital Assets Committee which makes the final decision on equipment purchases. From this file the best investments can be picked with proper consideration given to the most intangible factors of quality and safety. Consistent use of this formula shows us which investments will yield the greatest return on our money and enables the Committee to plan equipment purchases with confidence."

HAROLD F. FALK
Executive Vice President
THE FALK CORPORATION

ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When The Time For Replacement Arrives . . . . . .

February, 1954



Kaydon Reduces Turning

With a Sundstrand Automatic Lathe

This is only one example of how the Kaydon Engineering Corporation of Muskegon, Michigan uses this Sundstrand Model 16 Automatic Lathe in production runs of special bearings.

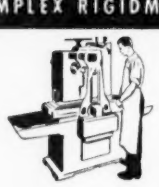
On one particular lot of 112 outer races 16" outside diameter, the time was cut over 50% including setup time.

Among the many parts run on this Sundstrand Automatic Lathe are inner and outer bearing races for straight roller bearings, taper roller bearings and spherical roller bearings, sizes ranging from 9½" to 23⅜" outside diameter.

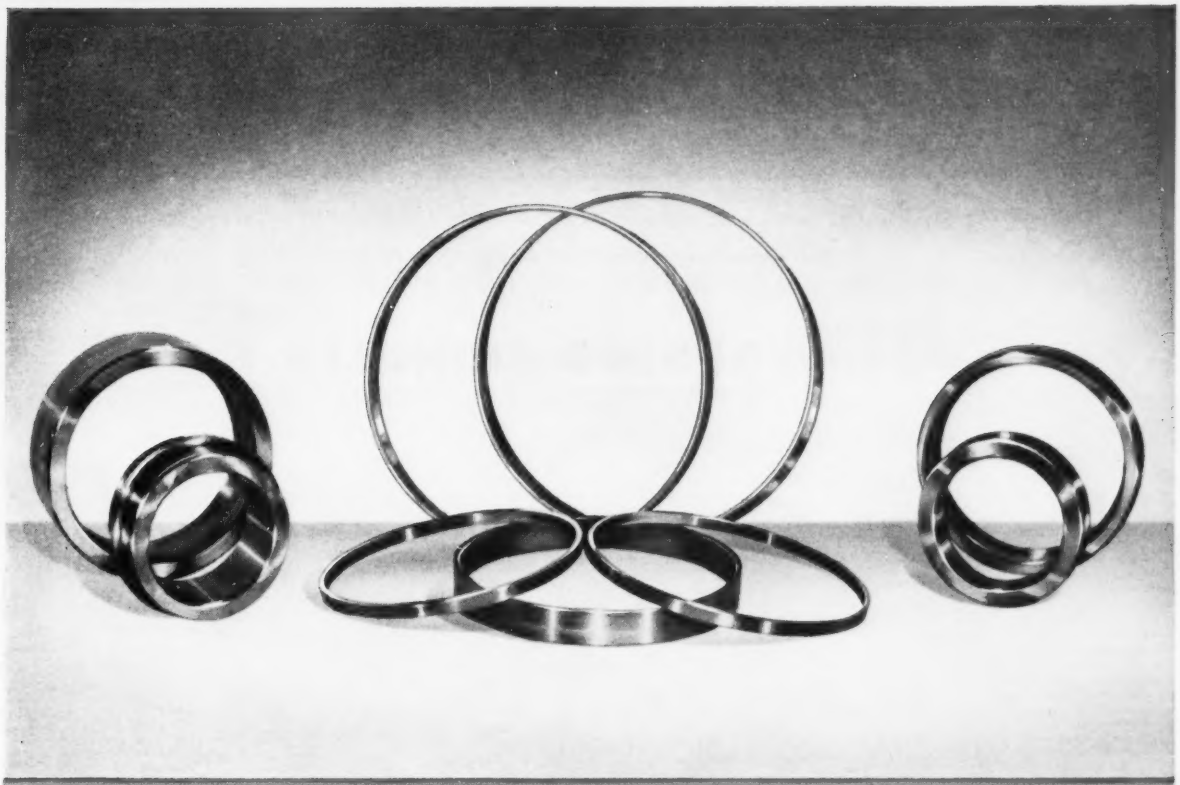
Boring, facing, turning, forming roller paths and ball paths, radii, chamfering and cutoff are the operations performed.

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



MADE IN
ROCKFORD...MACHINE TOOL SHOPPING CENTER
ILLINOIS, U.S.A.

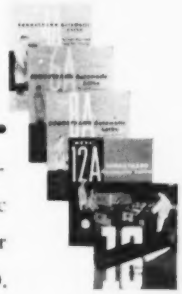


Time Over 50%....

Lot Sizes Vary From 100 to 1000 Pieces

On the various lots run, the production increase averages nearly 3 times the former method. There are many important features of Sundstrand Automatic Lathes that make them outstanding producers on both long run and small lots. For instance, complete control of all cycles is provided by adjustment of dogs on a disc. Making cams is eliminated. Changing position of dogs on the disc changes length of rapid approach, feed and rapid return stroke enables operator to set up cycle quickly and change over from one job to another with ease. Get the facts now. Write for the booklets offered below or call in a Sundstrand engineer. There is no obligation for this service.

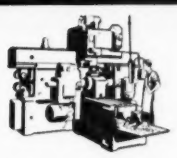
Free Data

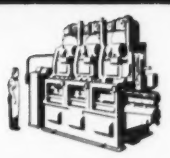


You'll find information on the complete line of Sundstrand Automatic Lathes in these 5 folders. Write for your copies today. Ask for bulletins 640.

SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

TRIPLEX RIGIDMILS | SPECIAL MACHINES

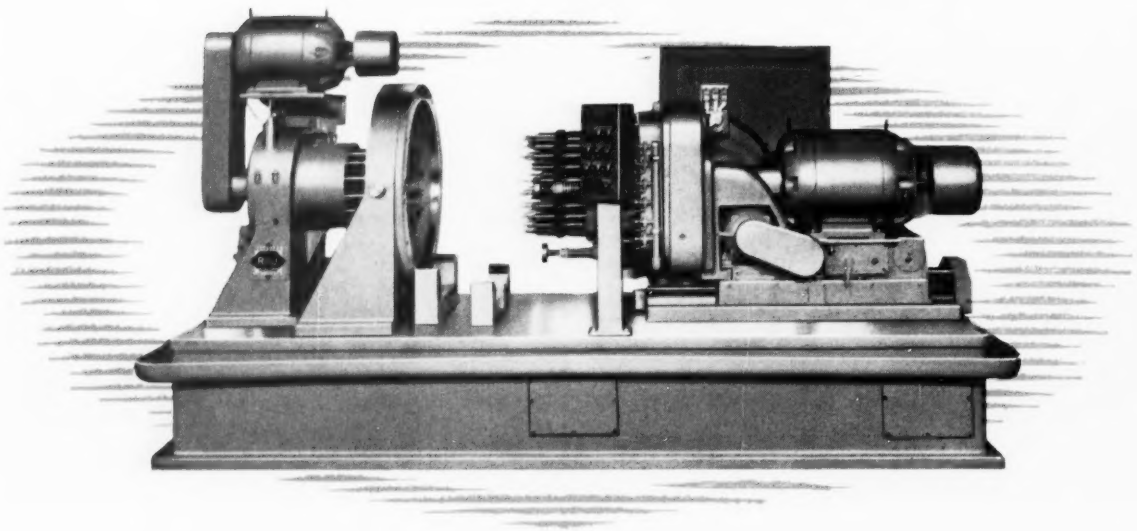




MADE IN
ROCKFORD MADE MEANS PRECISION MADE...**ROCKFORD**
ILLINOIS, U.S.A.

Rehnberg-Jacobson

48 TAPPING SPINDLES



FOR JET ENGINE COMPRESSOR FRAMES

This is one of two very similar machines that are used in sequence to tap a total of 84 holes on four different bolt circles. Each machine has a fixed head and a traveling head. The traveling head, at the right in the picture above, is driven by a Rehnberg-Jacobson ALL-MECHANICAL Power Feed Unit which rapidly traverses the 34-spindle tapping head up against a positive stop, after which the tap spindles advance and retract with individual lead screws. The 14-spindle *fixed* head at the left also feeds and withdraws its taps with individual lead screws. This machine taps fourteen 1/4″-28 holes on a 10-5/8″ bolt circle and thirty-four 5/8″-11 holes on a 16-3/4″ bolt circle. The companion machine taps twelve 7/16″-14 holes on an 11-1/2″ bolt circle and twenty-four 1/2″-13 holes on a 16″ bolt circle. The tapping cycle in the aluminum alloy piece is only 12 seconds, of which 7 seconds is approach and return, but nearly 4 minutes is allowed for loading and unloading, to give an average production of 15 pieces per hour. Like most R-J machines, the functions are ALL-MECHANICAL throughout for maximum understandability.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...FOR ACCURATE, FAST METAL REMOVAL
ILLINOIS, U.S.A.

NO WAITING...

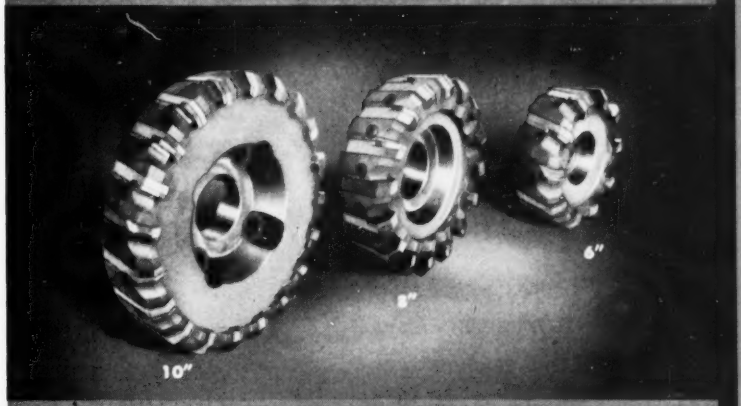
FOR THESE INGERSOLL HEAVY DUTY GENERAL PURPOSE FACE MILLS

The cutters illustrated here are available from stock. Other cutters can be supplied in a matter of a few weeks.

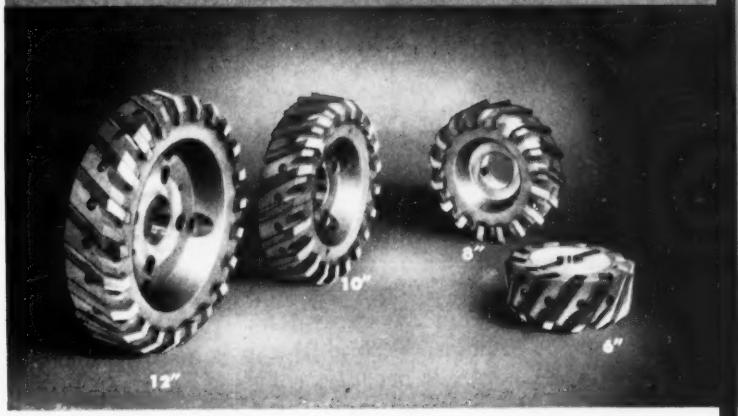
Replacement blades for all of these cutters and for many others also are in stock.

Improved manufacturing facilities and techniques have expanded our capacity to give you good service on all of your requirements for inserted blade milling and boring tools.

SHEAR CLEAR FACE MILLS with high speed steel blades . . . for cast iron, steel or aluminum



SHEAR CLEAR FACE MILLS with carbide-tipped blades . . . for cast iron . . . for steel



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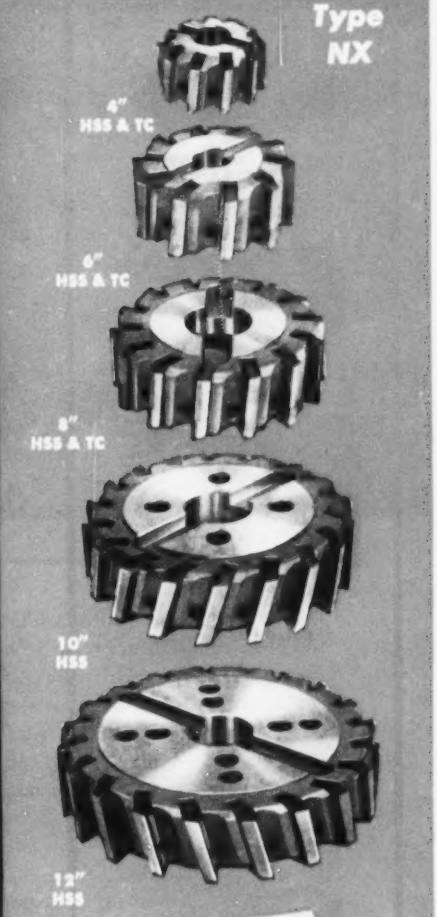


SHOWN ON PAGES 9, 12, 14, 18 & 19 of Cutter Catalog No. 60B. Write for your copy today.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U.S.A.

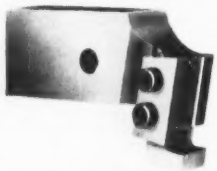
BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

FOR METAL REMOVAL WITH ACCURACY AND SPEED...

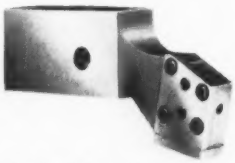
MADE IN ROCKFORD ILLINOIS, U.S.A.

GREENLEE *Automatics*

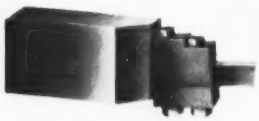
Circular Form-Tool Holder



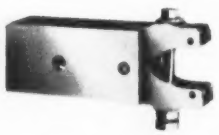
Dovetail Form-Tool Holder



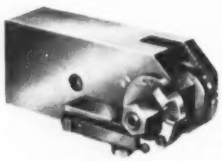
Bit-Type Form-Tool Holder



Cut-Off Tool Holder

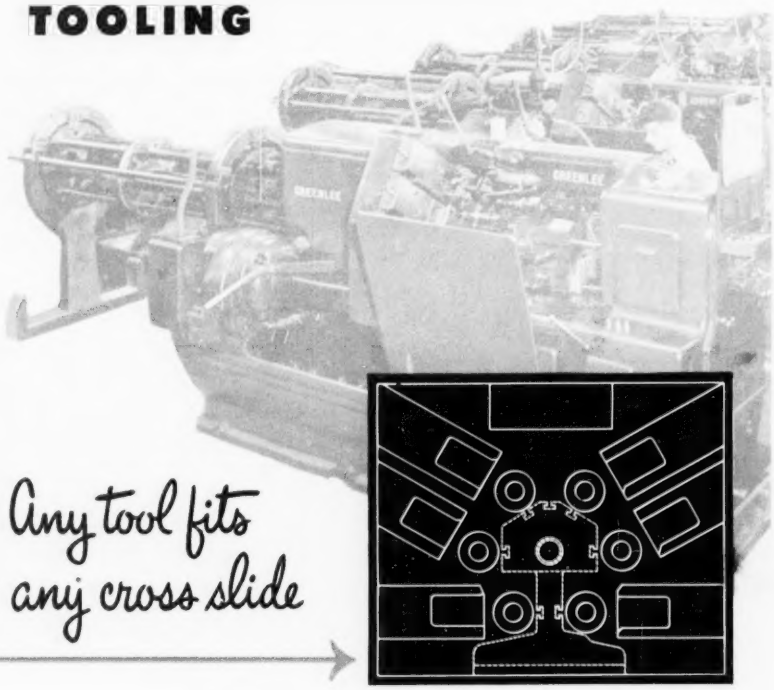


Knurling Tool Holder



Stencilling Wheel Holder

INTERCHANGEABLE TOOLING



Any tool fits any cross slide

SAVE TIME AND MONEY REDUCE JOB COSTS

Among the cost-saving features of Greenlee Automatics, one of the most advantageous is the arrangement whereby *any* of various standardized tool holders will fit in *any* of the six cross-slides. This means not only no limitations as to what tools can be used in which positions, but also a minimum requirement for investment in tools, and a maximum of speed in tool setting when changing over between jobs. *You can profit* from this and the many other outstanding features of Greenlee Automatics.

Write for FREE Literature

Send today for your copy of our 20-page booklet describing and illustrating all the Greenlee features.

PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO.
1862 MASON AVE., ROCKFORD, ILL.

MADE IN ROCKFORD... MACHINE TOOL PLANTS CLOSE TO YOUR PLANT
ILLINOIS, U.S.A.

DUPLICATE FORM MACHINING

DIRECT TRANSFER • NO INTERMEDIATE MOTION

with ROCKFORD KOPY-KAT duplicator

Hy-Draulic

Inaccuracies are eliminated in duplicate form machining with Rockford Kopy-Kat Duplicators due to the absence of intermediate motion. Here, a Kopy-Kat Duplicator is shown reproducing a three-dimensional form, transferring the form directly to the cutting tool on a Rockford Openside Shaper. The hydraulic duplicator valve is so sensitive, so exact, that positive duplication of complex forms is done with the ease of straight-production machining.

A Rockford Machine Tool Co. Representative will show you how Kopy-Kat duplicating simplifies your form-machining problems. Get the full details from him, with examples on many varied and complex forms and shapes.

ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET, ROCKFORD, ILLINOIS

MADE IN

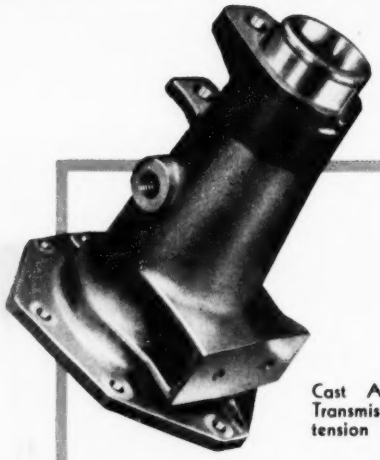
CENTER OF MACHINE TOOL EXCELLENCE... **ROCKFORD**

ILLINOIS, U.S.A.

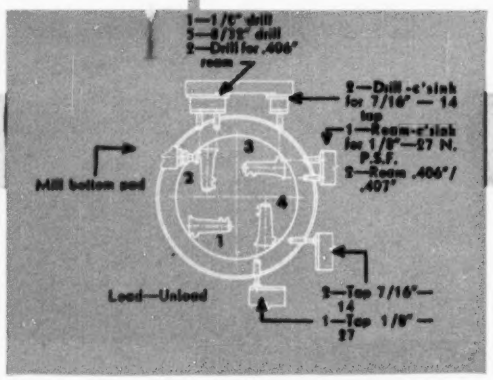
118 *Pieces per hour* 35 *Operations....*

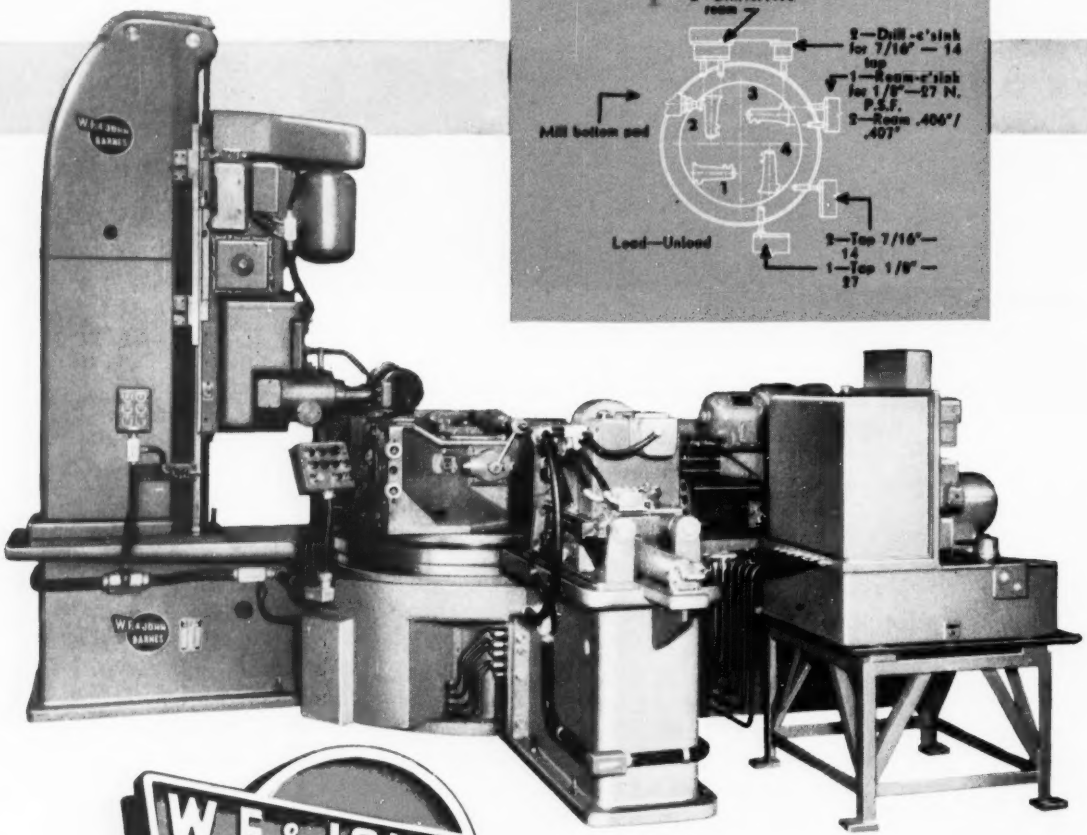
TRANSMISSION EXTENSIONS MACHINED TO CLOSE TOLERANCES ON COMPANION UNITS

Here is another typical example of how W. F. & John Barnes coordinated special machine engineering and building service helps solve complex machining problems. These two companion units, designed to machine cast aluminum automobile transmission extension housings, reduce production costs by combining operations. Note how the parts are positioned and the tooling arranged for efficient machining, and how the over-all design conserves floor space. The two machines perform 35 operations at the required gross production rate of 118 pieces per hour. Whether your production requires large or small machines, you'll find the coordinated services at Barnes can help you solve problems quickly and efficiently.



Cast Aluminum Transmission Extension Housing





Barnes 4-Station Special Machine with 48" diameter hydraulically operated rotuting table. This unit performs 17 operations. Vertical milling of bottom pad in Station No. 2 is completed with a retracting spindle. Fixtures locate part on end bores.

W. F. & JOHN BARNES COMPANY

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

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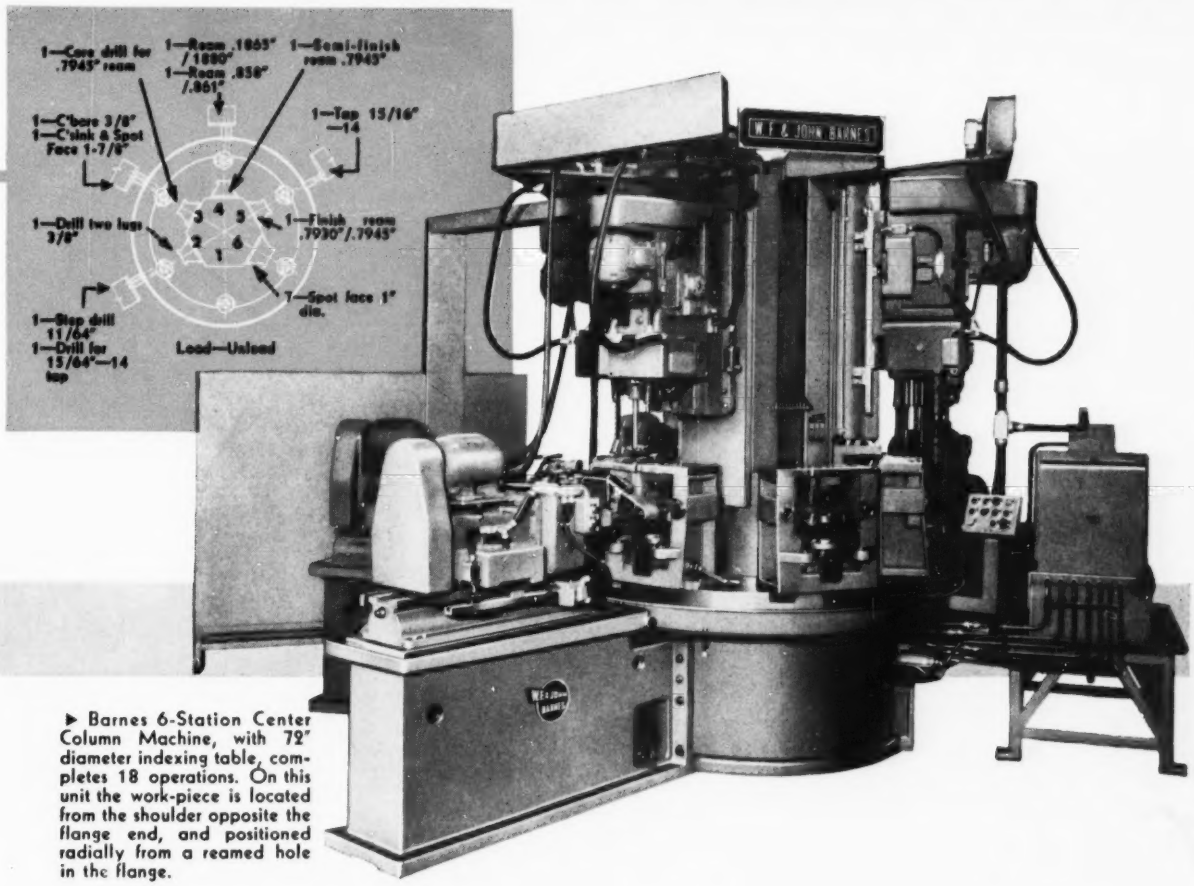
ILLINOIS, U. S. A.

. . . ON W. F. & JOHN BARNES SPECIAL MACHINES



▶ Barnes 6-Station Center Column Machine, with 72" diameter indexing table, completes 18 operations. On this unit the work-piece is located from the shoulder opposite the flange end, and positioned radially from a reamed hole in the flange.

BARNES SPECIAL MACHINE TOOL BUILDING SERVICE INCLUDES

1 **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to produce high production machines.

2 **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.

3 **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control with circuits that assure the most dependable coordination of all machine functions.

4 **SPECIAL GAUGES, FIXTURES, TOOLS** — designed for each individual machining problem, assure accuracy of operations at high production speeds.

5 **SPECIAL HANDLING AND CONVEYOR EQUIPMENT** — designed and built to reduce work handling, effect maximum safety and efficiency.

6 **COORDINATED DESIGN AND ENGINEERING** Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

Write **FOR FREE DATA**

"Coordinated Machine Engineering" — a free booklet describing modern machines and mass production techniques. Write for your copy today.

310 S. WATER ST., ROCKFORD, ILLINOIS

AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

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YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... ROCKFORD

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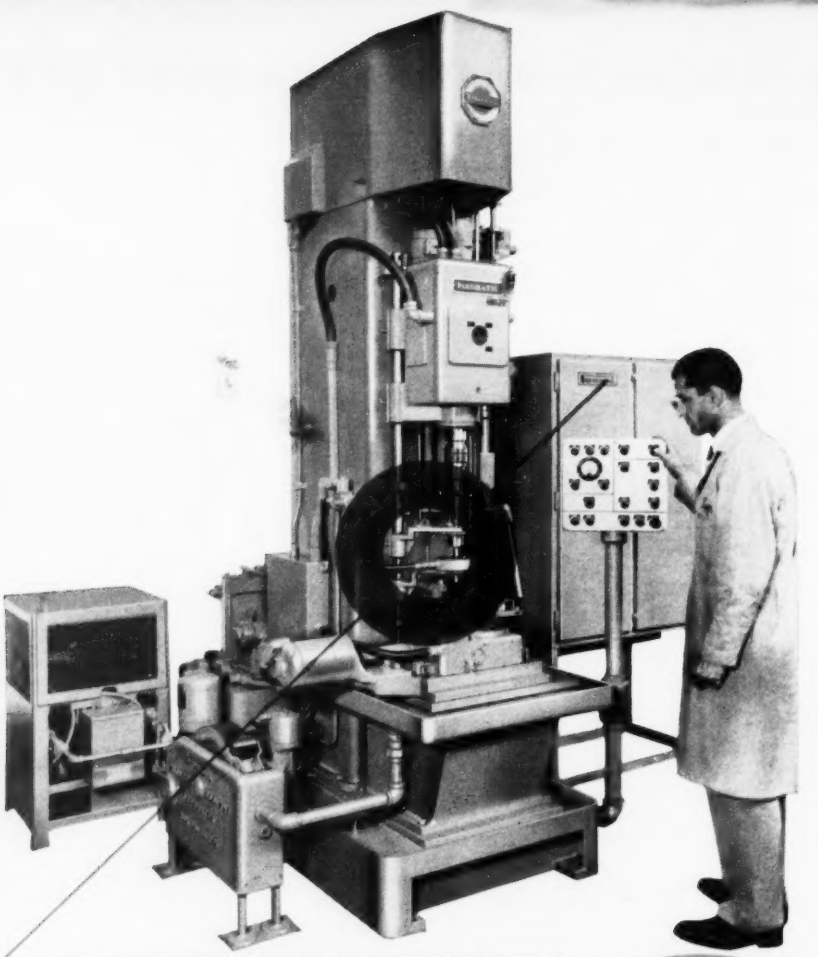
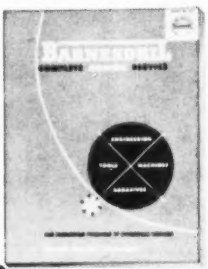


PRECISION HONING

Fully Automatic with Plugmatic Sizing

BARNESDRILL New No. 223 Honing Machine Sizes Bores Accurately, with Selective Finish, removing stock to predetermined limits. Roundness, straightness, finish and size are automatically controlled through **BARNESDRILL** Plugmatic sizing which gauges the honed bore direct.

This new method offers you one type of sizing for regular, counter-bored or blind end bores.



Write for full information.
Ask for Bulletin B5005.

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

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ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

Mattison Grinder beats old time (15 hours) by 12 hours

The picture above shows a punch and die grinding operation on a Mattison High-Powered Precision Surface Grinder at Lyon Metal Products, Incorporated. Previous time on a converted planer-grinder was 15 hours — now with a Mattison Grinder equipped with special fixture. grinding time has been reduced to 3 hours.

Mattison Grinders are proving profitable investments in plants where "time out" for reconditioning is a vital factor in meeting production schedules. Surfaces are reconditioned and edges sharpened in a minimum of time, eliminating costly delays and holdup of production. Many manufacturers installing the Mattison Grinder for reconditioning dies find many other uses for it in grinding flat surfaces where accuracy and fine finish are required. For complete information on the Mattison High-Powered Precision Surface Grinder, send for free copy of our latest circular.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

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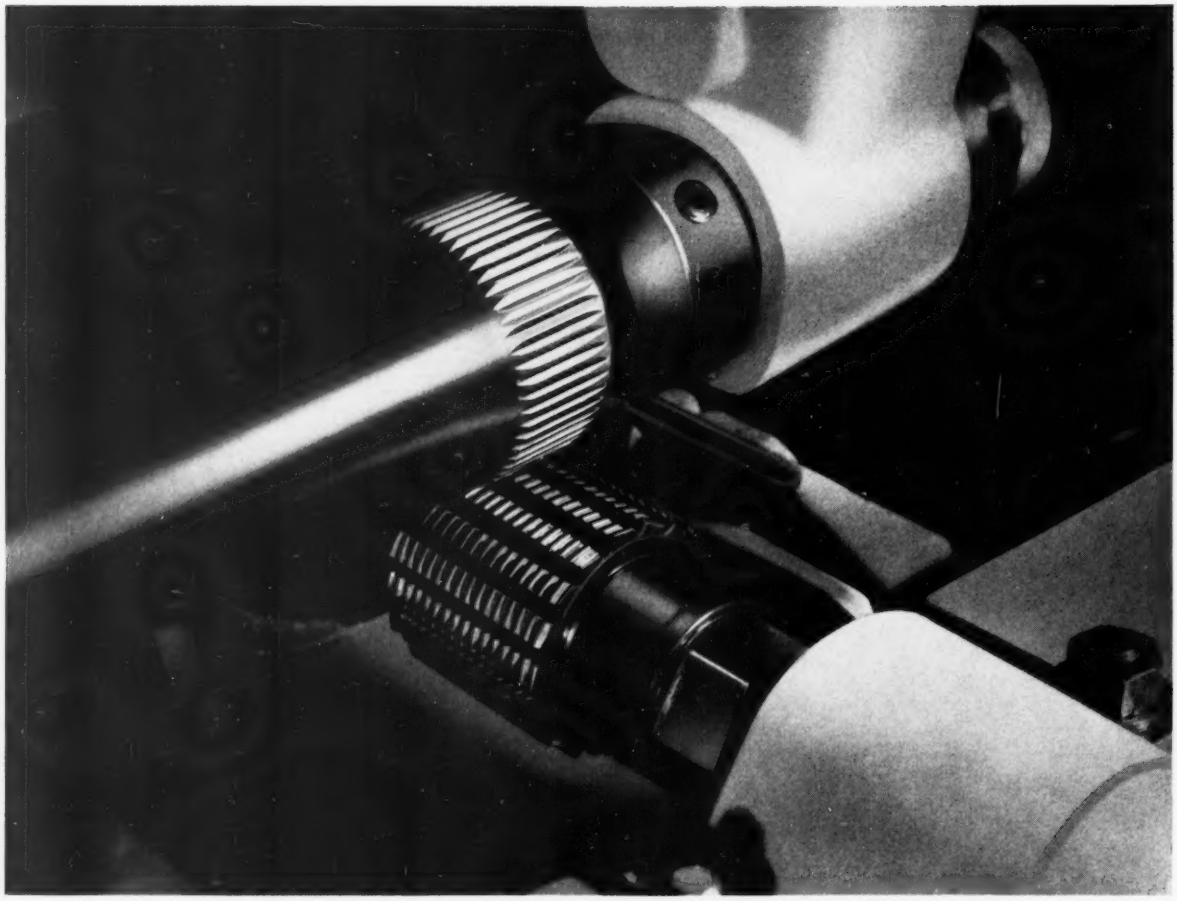
FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD
ILLINOIS, U.S.A.



Barber-Colman HOBBING

DOUBLES TOOL LIFE · CUTS PRODUCTION TIME

HARD STEEL TORSION BARS,
45-50 R. C.

Hobbing tough, hard materials — such as this torsion bar job — presents no special production problems when you use the Engineered Hobbing approach.

These torsion bars, 45-50 Rockwell "C", approach the upper limit of machineability for hobbing. Structure and toughness of the material caused hob teeth to wear rapidly.

Barber-Colman Hobbing Engineers worked closely with production officials in this plant to produce the desired results on this job. Substantial tool savings, increased tool life, and better production time resulted. Total hob life has increased from approximately 600 to over 1200 ends.

BUILDERS OF PRECISION GEAR

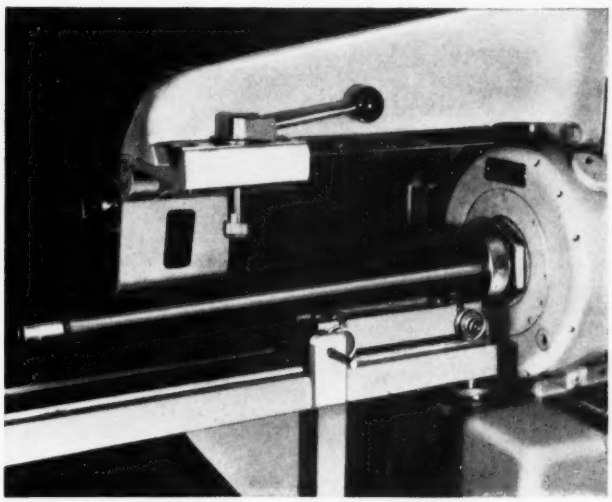
MADE IN
ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS
ILLINOIS, U.S.A.

TOOL COSTS REDUCED WITH
CLASS C ACCURATE UNGROUND HOBS

Barber-Colman engineers recommended 4-thread Class C Accurate Unground Hobs and automatic hob shifting to increase tool life and production in this hard material. Results showed an average increase from 65 to 120 hobbed ends per hob sharpening. The use of unground hobs has reduced tool cost considerably. Cutting time is 5 minutes per end, the length of cut being 1⅛".

The form on the hob is a 48° 44′ pressure angle serration with a full radius at the top of the tooth. The hob is non-topping. Climb hobbing allows the hob tooth to start its cut in metal which has had no opportunity to be work hardened.

COMBINED ENGINEERING OF HOBS, TOOLING AND MACHINES PRODUCES BENEFITS



Results obtained on this hobbing job show the benefits possible when hobs, machines and tooling are combined through proper engineering to meet the specific problems of the job.

New No. 16-16 Hobbing Machines are used, equipped with 30" rear overhanging center bracket. Bars are loaded from the rear of the spindle, where the operator easily pushes them from a conveyor into the spindle. A special steadyrest bracket guides the bar and protects the hob while loading. Work change time is 1½ minutes.

You, too, can simplify your hobbing problems by consulting Barber-Colman engineers. Why not contact them today for an evaluation of your hobbing methods.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 622 ROCK STREET, ROCKFORD, ILLINOIS, U.S.A.

HOBS AND MACHINES SINCE 1911

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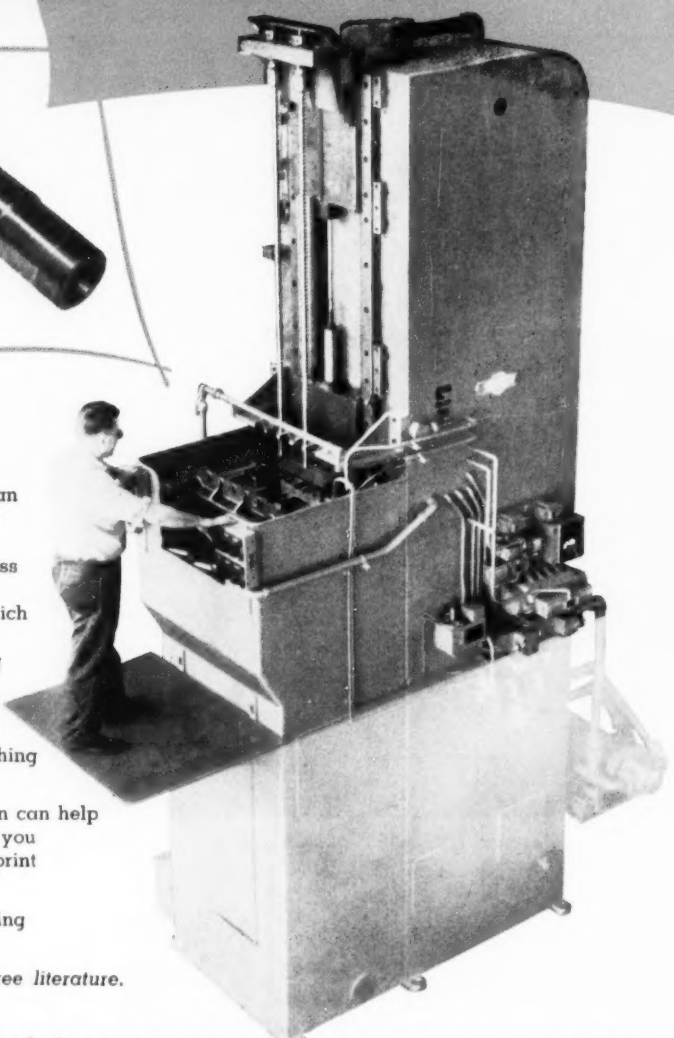
YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... ROCKFORD
ILLINOIS, U.S.A.

FASTER SPLINE BROACHING

the *American* way

Check these broaching features that make it possible...

- ✓ Multiple station set-up
- ✓ Load while broaching
- ✓ Hydraulic transfer slide
- ✓ Automatic ejection of parts
- ✓ Interchangeable tooling for several parts



Splined holes are broached simultaneously in five parts in one pass on this five-station American 40-Ton 72" stroke pull-down machine. A transfer slide permits the operator to reload parts during the broaching cycle. The parts are loaded on cross hole locating pins mounted on the transfer slide, and then moved into stationary holding jaws, which hold them in broaching position. The slide then moves back allowing the operator to reload during the broaching stroke. After broaching the parts are automatically ejected from the spring loaded holding jaws by a swinging bar. Interchangeable tooling, easily changed over, allows for the broaching of several different parts.

This machine is another example of how American can help you obtain high production with low unit cost. If you have a metal-removing problem, just send a part print and sample for a free estimate.

American *engineers and builds all three*—broaching machines, broaches and broaching fixtures.

Write today for free literature.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

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ILLINOIS, U.S.A.

eliminate the guesswork in selecting tool steels

Thousands of metal working people are using the Crucible Tool Steel Selector to determine exactly which type of steel they need. This handy selector covers 22 tool steels which fit 98% of all tool steel applications.

The selector is unique because it starts with the ultimate use of the steel. It breaks down all tool steel applications into six major classifications, under which the different grades of steel available for certain specific requirements are indicated in legible cutouts. Heat treatment and machinability data are also included for each grade.

A flip of the dial will give you the answer, and almost just as quickly you can get the steel you select. For each type of steel shown on the selector is in stock in Crucible warehouses, conveniently located throughout the country.

To get your Selector merely fill in the coupon and mail. There is no obligation whatsoever.

⅓ actual size, Selector is in 3 colors

HERE'S AN EXAMPLE:

Application – Deep drawing die for steel

Major Class – Metal Forming – Cold

Sub-Group – Special Purpose

Tool Characteristics – Wear Resistance

Tool Steel – Airdi 150

A turn of the dial does it! And you're sure you're right

Crucible Steel Company of America
Dept. M, Oliver Building
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Name_____

Company_____ Title_____

Address_____ City_____ State_____

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

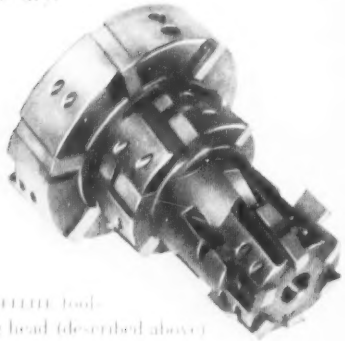
TOOL STEELS

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

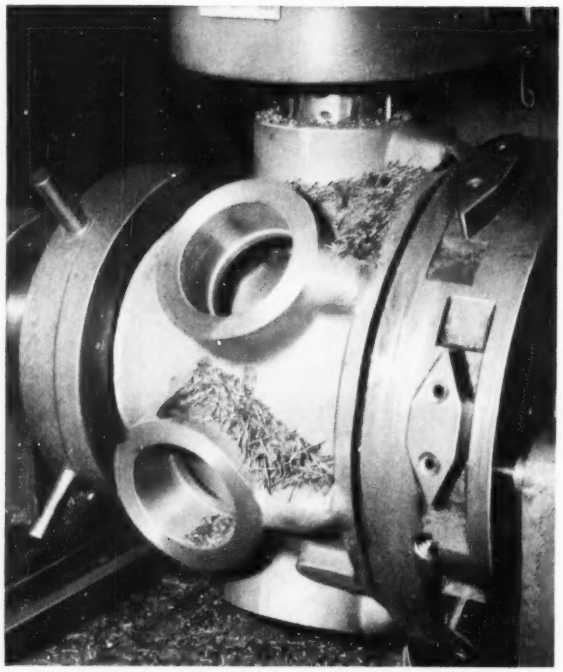
More Life Between Grinds With...
HAYNES STELLITE Tools

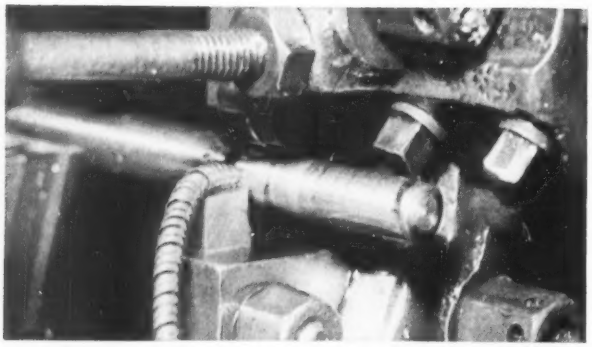
2,000 CYLINDER WALLS PER GRIND

The HAYNES STELLITE tools used in this multiple boring head last from 4 to 6 weeks between grinds. The part is a cast iron compressor housing. Machining was complicated by mold sand inclusions and intermittent cuts due to irregular contours and variations in chill depth. Spindle speed is about 45 r.p.m., and machining is done dry.



The 20 HAYNES STELLITE tools used in this boring head (described above) are usually good for 25 grinds.

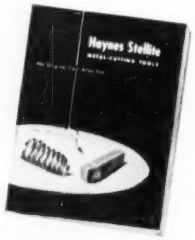




TOOL LIFE INCREASED FROM 6 TO 12 TIMES

The longer life of HAYNES STELLITE tools saved this plant from 1 to 2 hours each day in grinding time alone. The parts being machined are chromium-molybdenum shafts with a hardness value of 269 Brinell. HAYNES STELLITE tools averaged 80 shafts every 3 hours before they had to be ground. Tools previously used had to be ground every half hour or less, producing as few as 5 shafts per grind.

For further information about HAYNES STELLITE tools, and how they may be useful to you, write for the booklet entitled, "HAYNES STELLITE Metal-Cutting Tools." This practical manual of cutting tool practice is published as a service to you.



HAYNES STELLITE

Trade-Mark

Metal Cutting Tools

The original cobalt-chromium-tungsten metal-cutting tool.

"Haynes Stellite" is a registered trade-mark of Union Carbide and Carbon Corporation

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A Division of
Union Carbide and Carbon Corporation
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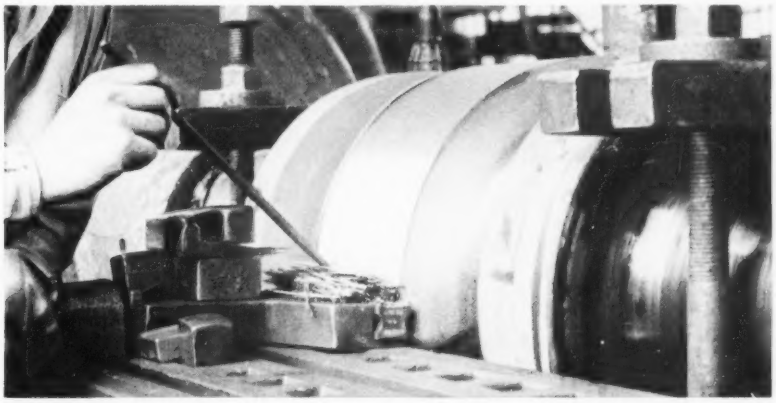
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

For more information on products advertised, use Inquiry Card, page 243

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Red Sabre Bit Does Double Duty

Roll dressing in a mill where steel bars are rolled had long been considered an operation requiring two types of tool steels. For the roughing cuts they used tool bits made of high-speed steel. And for the finishing cuts, they turned to water-hardening steels.

But someone got to thinking, Why not try Red Sabre? Then maybe one tool steel could be used for both jobs.

So Red Sabre was put to work, and is giving an excellent account of itself on alloy iron and cast steel rolls having a hardness of 48 to 60 Shore.

The roughing operation is shown above. The hardened and ground block cutter tool, $1\frac{1}{4}$ in. high, $1\frac{1}{2}$ in. wide, and $8\frac{1}{4}$ in. long, and with four cutting edges, is making a cut approximately .006 in. deep. The finishing cut, less than .001 in. deep, is made without changing the tool set-up. Both operations are performed at a surface speed of 40 in. to 60 in. per minute, depending on the diameter of the roll.

Red Sabre is our super high-speed steel, containing approximately 1.50 carbon, 12.00 tungsten, 5.00 vanadium and 5.00 cobalt. It is unusually resistant to abrasion and wear, and has higher red hardness than most high-speed steels.

Red Sabre tool bits, hardened to a minimum of Rockwell C-65 and accurately ground, are stocked in all standard sizes. If you'd like to try them out in your shop, put it up to your tool steel distributor. Or if you prefer, order direct from us at Bethlehem, Pa.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

This Is Why We Anneal Most Tool Steel Bars

In the majority of cases, bars of Bethlehem tool steel are furnished in the annealed condition, both to users and distributors. There are two important reasons why this is so:

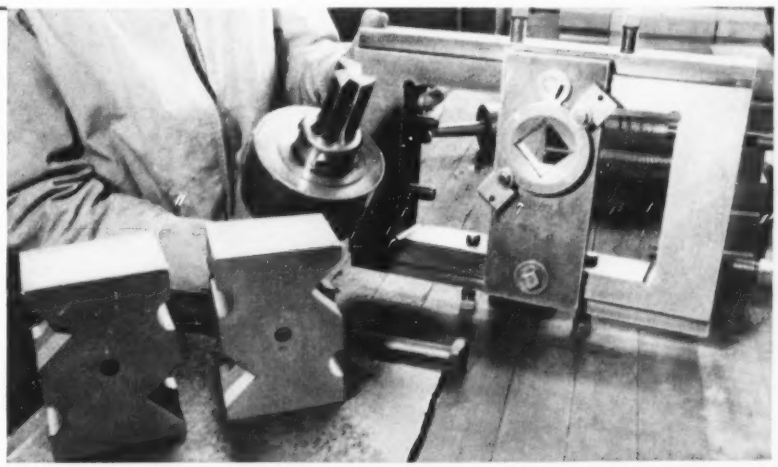
1. The process of annealing makes it possible to remove the stresses occurring in the as-rolled or as-forged bars. If such stresses were not removed, they could very well lead to cracking, resulting in delay and increased shop costs.

2. With many types of tool steels, it is necessary to obtain the lowest degree of hardness in order to secure the best machinability. But for other grades of tool steels, low hardness is undesirable. For this reason, annealing is carefully controlled to produce the proper degree of hardness for the grade involved.

Here's another point to remember—excessive scaling and decarburization must be avoided during annealing. We find the bell type, controlled atmosphere furnaces used in our tool steel mill excellent for this purpose. In fact, with these furnaces we obtain results which are far superior to what is possible when other types of annealing equipment are used.

MACHINE BOLT FORMING DIES MADE OF CR-MO-W

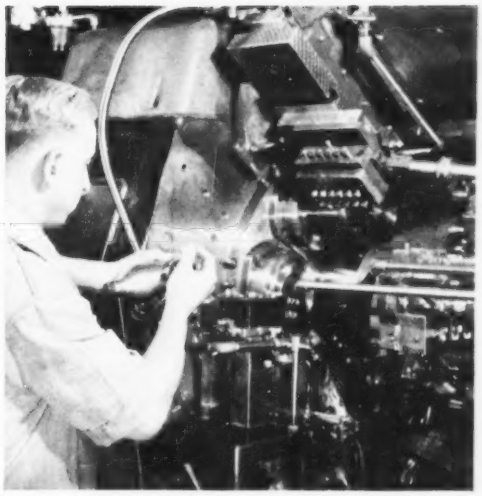
Making forming dies which are capable of turning out thousands of square head machine bolts each day is a task calling for a top notch grade of tool steel. That's why Bethlehem Pacific, the largest maker of bolts on the West Coast, selected Cr-Mo-W (Chrome-Moly-Tungsten) tool steel for making dies used in bolt manufacture. Like many other tool steel users, they find Cr-Mo-W ideal for jobs involving shock or drastic temperature changes, as well as for applications where heat-checking is a problem. Cr-Mo-W, our general purpose type of hot-work tool steel, is air-hardening, and has good red-hardness and good machinability.



MACHINABILITY
LIKE THIS

6 HELPFUL MANUALS

filled with how-to-do-it information and data to help you use Republic Union Cold Drawn Steels. Write for "Union Drawn Pocket Library."



can cut your unit costs

Here's a suggestion:

Take any one of the parts shown above — any steel part, for that matter. Make it out of ordinary cold drawn steel. List your unit costs.

Then make the same part out of Republic Union Cold Drawn Steel. Like many others, you may find that the uniformly high machinability of Republic Cold Drawn Steels can help your unit costs look their best.

We have the facts to prove it. Not only from our customers, but right in our own plant where we pre-test this machinability on our own "automatics."

And to help you get the most in machinability from Republic Cold Drawn Steel, we will be glad to send one of our metallurgists or machining engineers. He will visit your plant, swap ideas on speeds and feeds with your plant men and engineers. He will work with your staff to see that you get high production efficiency, low unit costs, long tool life, and uniformly high product quality. Call your nearest Republic sales office for the facts. Or write to:

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

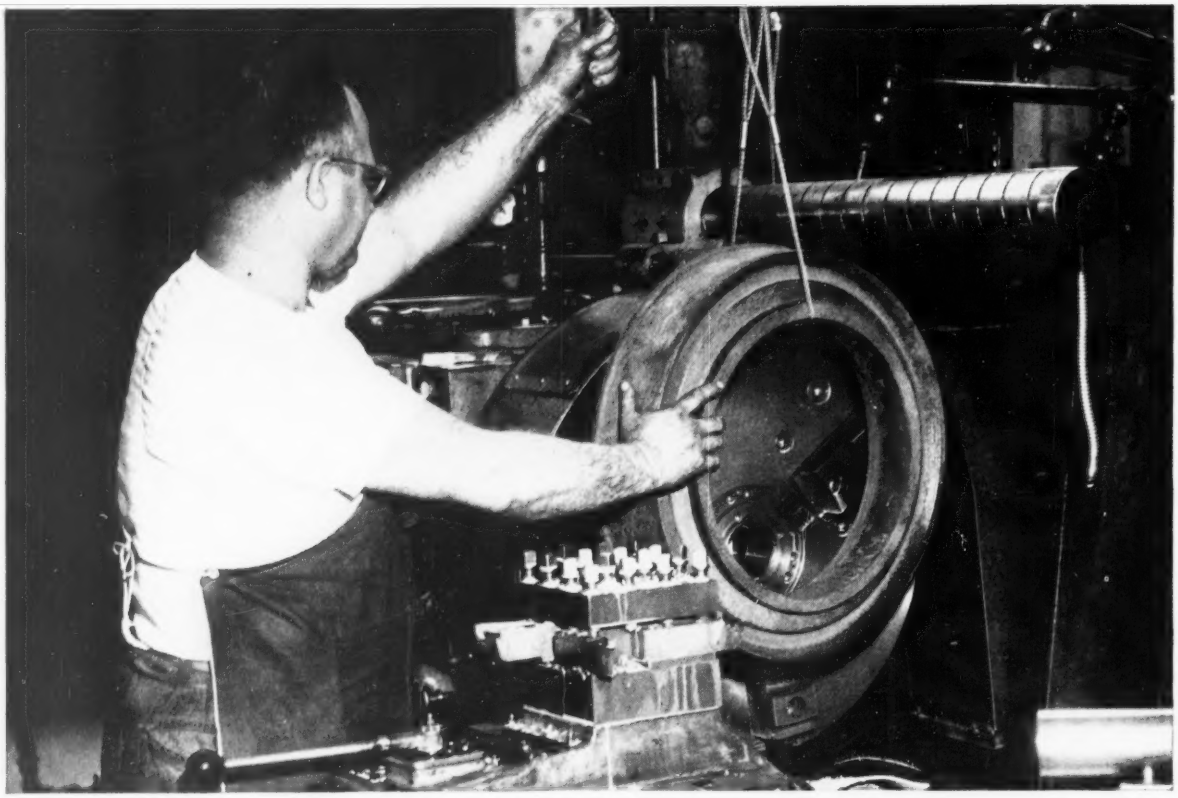
Free-Machining Bessemer, Alloy and Enduro Stainless Steels

Union Cold Drawn Special Sections

Union Cold Drawn and Ground Rounds, Turned and Polished Rounds, and Turned, Ground and Polished Rounds (Union Precision Shafting)

REPUBLIC *Union*® COLD DRAWN STEELS

REPUBLIC STEEL



Circular blank being positioned for machining at a General Electric plant.

So Many Uses for These Sturdy, Low-Cost Blanks

If the products you make require the use of circular steel blanks, we have something that will interest you. We mean Bethlehem's circular forgings, as they are known to the trade. Actually, these strong, homogeneous blanks are both forged and rolled, with the attendant benefits of the two-way process.

Customers use them for making gears, including spur, bevel, and herringbone; crane-track wheels, end rings, sheave wheels, turbine rotors, flywheels, tire molds and rings, industrial wheels, pistons, clutch drums, and similar parts. For all such applications Bethlehem blanks are the solid, logical choice—the ideal choice, really.

Large spur gears made from Bethlehem blanks.

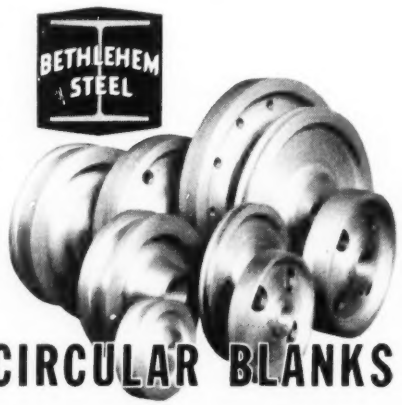
We have mentioned that they are strong. Other advantages include excellent grain flow and uniform density of metal. Because of this latter feature, machinists can take cuts of required depth with confidence; fewer finishing cuts are required, and the cutting speed is often higher.

Your own firm can probably find plenty of uses for these sturdy forged-and-rolled steel blanks. They are available in a wide range of sections, and they can be furnished untreated or heat-treated, as you prefer. Sizes run from 10 in. to 42 in. OD.

We're always glad to tell you the full story, any time you wish. But before we do, perhaps you'd like to send for our Booklet 216. It shows how the blanks are made, and how they are used by many well-known companies. Write for a copy today.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor—Bethlehem Steel Export Corporation



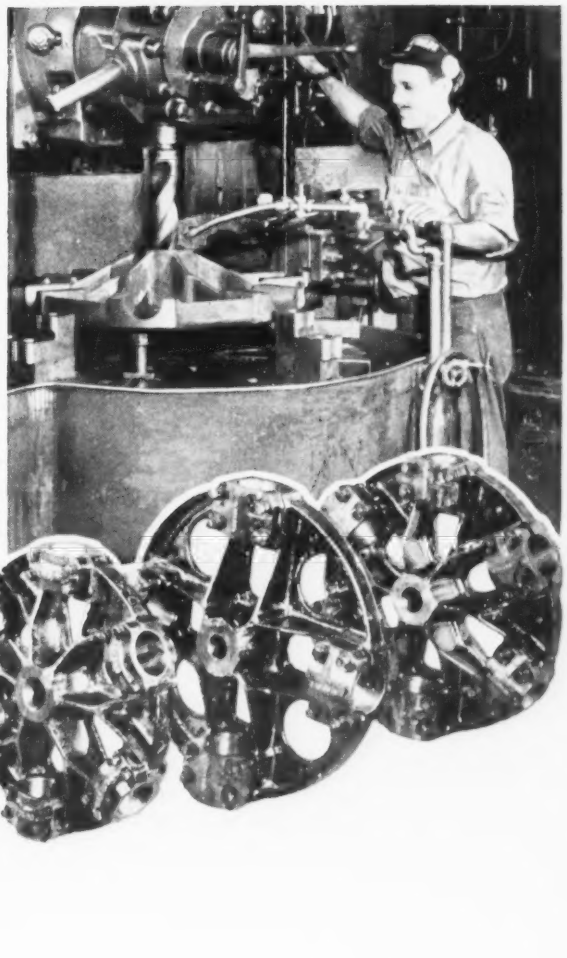
BETHLEHEM FORGED-AND-ROLLED CIRCULAR BLANKS

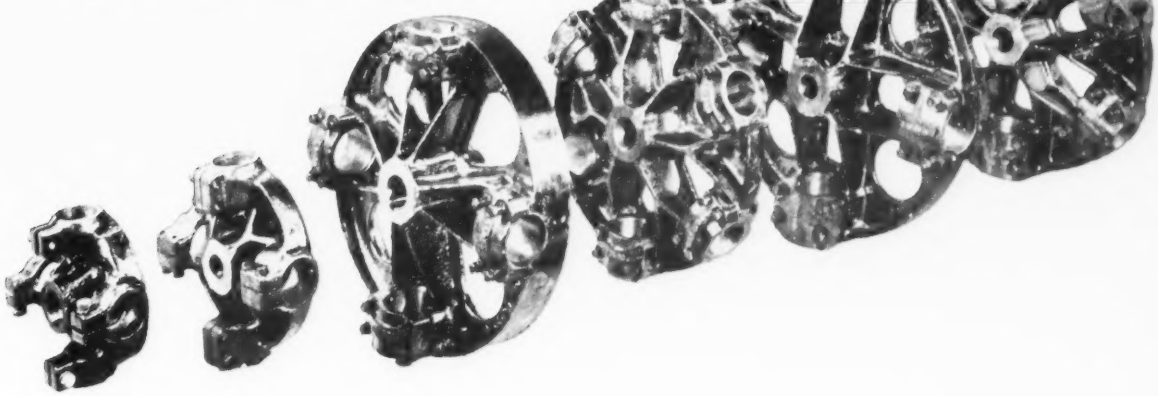
How Ductile Iron Cut Costs:

33% Reduction in Tool breakage

25% Longer use of Tools between Dressings

10% Increased Lathe Speeds and Feeds





Who will be next to make better products for less money by using Ductile Iron?

Profit from the example of Metal Products Division of Koppers Company, Inc., Baltimore 3, Md. This manufacturer not only cut costs but improved performance of one of their specialties by adopting Ductile Iron hubs for "Aeromaster" industrial fans.

These propeller-type fans, ranging from 54 inches to 24 feet in diameter, are generally used in pipeline pumping stations and similar places where vibrations from nearby engines, compressors or other machinery compound the vibrations of a fan.

INCO

For the hubs, which may vary from 50 to 225 pounds in weight, good tensile and fatigue properties are obviously essential. In addition, excellent castability is needed because the heavy center portion, the heavy flange and the thin inter-connecting webs of each hub vary considerably in section thickness.

So far, no Ductile Iron hub has been rejected. The manufacturer sand-blasts hub castings and then heat-treats to provide 60,000 p.s.i. minimum tensile strength and 15% elongation.

Tensile strengths in excess of 150,000 p.s.i. may be attained by other heat-treatments. Investigate how Ductile Iron can improve your products or equipment. Learn the facts about its machinability, its resistance to wear, to shock and vibration. Investigate the facts about its damping capacity.

Send us details of your prospective uses, so that we may offer a list of sources from some 100 authorized foundries now producing Ductile Iron under patent licenses. Request a list of available publications on Ductile Iron . . . mail the coupon now.

The International Nickel Company, Inc.
Dept. 20, 67 Wall Street, M-2-54
New York 5, N. Y.

Please send me a list of publications on DUCTILE IRON

Name _____

Title _____

Company _____

Address _____

City _____ State _____

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N. Y.

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HE has it...

the thing you want!

NO NEED to search through directories or ask people about it. When you need a finished bearing, a bar of bearing bronze or any other one of countless items of industrial materials and equipment, just phone your industrial distributor.

YOUR BUNTING distributor is the leading industrial distributor, or a stock-carrying specialist in certain industrial items. With money-saving convenience, he can supply hundreds of different sizes of completely machined and finished Bunting Standard Stock Industrial Bearings, Electric Motor Bearings and Precision Bronze Bars.

Ask him for a Bunting Catalog which gives complete dimensional and technical data.

Bunting®

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS

The Bunting Brass & Bronze Company • Toledo 1, Ohio • Branches in Principal Cities • Distributors Everywhere

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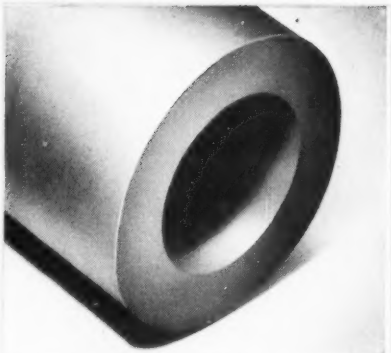
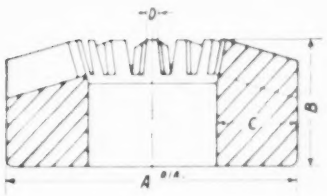
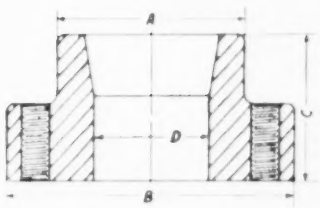


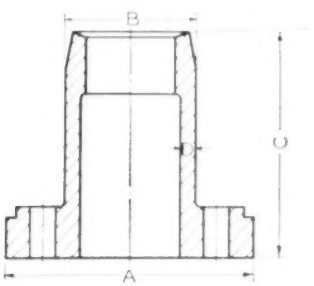
PERFORATING DIE



SIZING DIE



FORMING AND PIERCING DIE



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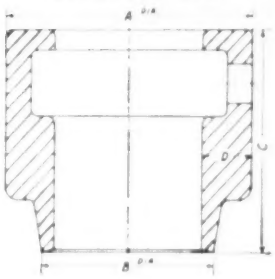
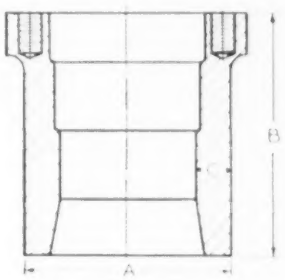


BLANKING AND FORMING DIE



How Graph-Mo® Hollow-Bar speeds production of ring-shaped tool steel parts like these

New GRAPH-MO® HOLLOW-BAR eliminates drilling—and machines 30% faster

IF you make ring-shaped tool steel parts, you can start with finish boring by using Graph-Mo® Hollow-Bar. There's no drilling—the hole's already there. You speed production, cut scrap waste and save steel.

At the same time, you get all the proved advantages of Graph-Mo. Because of the free graphite in its structure, Graph-Mo machines 30% faster than other tool steels; has a minimum tendency to pick up, scuff or gall. And the combination of free graphite and diamond-hard carbides gives Graph-Mo Hollow-Bar exceptional durability. Users report that it outwears other tool steels on an average of 3 to 1.

Stability tests prove Graph-Mo is the most stable tool steel ever made. For example, after 12 years a typical Graph-Mo steel master plug gage showed less than 10 millionths of an inch dimensional change. It responds uniformly to heat treatment, too.

Make sure you're getting all the advantages of Graph-Mo Hollow-Bar if you make ring-shaped tool steel parts. Sizes range up to 16" O.D. with a variety of wall thicknesses. Graph-Mo Hollow-Bar is distributed through A. Milne and Co. and Peninsular Steel Co. warehouses.

For more information about Graph-Mo Hollow-Bar, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

TIMKEN®

TRADE MARK REG. U.S. PAT. OFF.

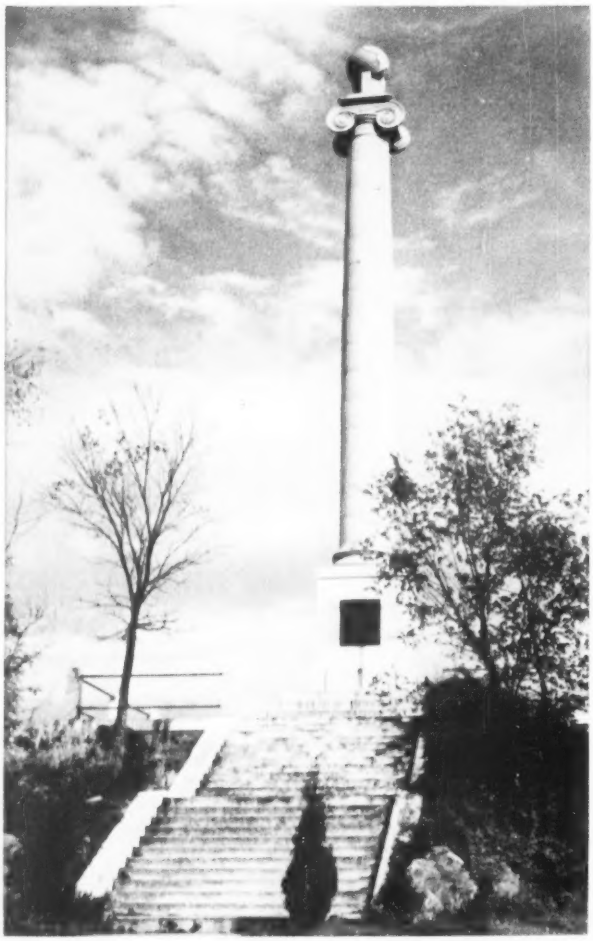
Fine Alloy

STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

CUMBERLAND GROUND BARS

We manufacture 8″ diameter, 7-1/2″, 7″, 6-1/2″, 6″, and also odd and intermediate sizes down to and including 1-1/8″.

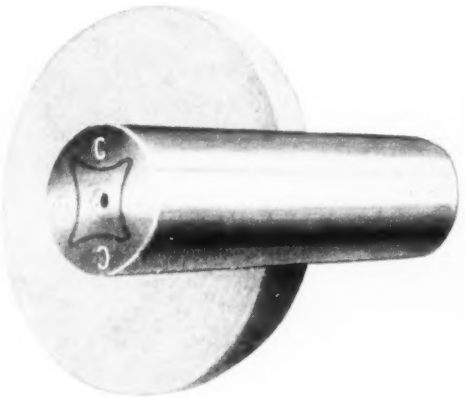


ON THE WEST VIRGINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was shown the, Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of secrecy—."

At a later date GEORGE WASHINGTON said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to filing or fitting.

IMMEDIATE BARS

DISTRIBUTED BY

Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkridge Brothers Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, N. Y.—Jos. T. Ryerson & Son, Inc.
Cambridge, Mass.—Brown-Wales Company
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Chicago, Ill.—Central Steel & Wire Co.
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Detroit, Michigan—Central Steel & Wire Co.
Forth Worth, Texas—C. A. Fischer
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Oakland, Calif.—Link Belt Co., Pacific Div.
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Providence, R. I.—Congdon & Carpenter Co.
San Francisco, Calif.—Link Belt Co., Pacific Div.
Seattle, Wash.—Link Belt Co., Pacific Div.
Spokane, Wash.—Link Belt Co., Pacific Div.
Toronto, Canada—Drummond, McCall & Co., Ltd.
Worcester, Mass.—Pratt & Inman

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 INCORPORATED 1892

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"Yes...you can make it in stainless. Free-Machining ENDURO is fully 90% as machinable as Bessemer screw stock"

You can give parts the high physical and chemical properties of ENDURO Stainless Steel—and, at the same time, maintain high rates of automatic production.

You do it by converting to ENDURO bars which are cold-finished by Republic's Union Drawn Steel Division. Two grades are fully 90% as machinable as Bessemer screw stock.

They offer close tolerance, accuracy of section, uniform soundness, and fine surface finish.

Republic ENDURO Stainless Steel also is available in hot-rolled bars and in wire. And, Republic metallurgists are ready to help you every step of the way in selecting and applying the proper grades for best production. Just write:

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

Republic ENDURO
FREE-MACHINING
STAINLESS STEEL

REPUBLIC STEEL

Other Republic Products include Carbon and Alloy Steels—Pipe, Sheets, Strip, Plates, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

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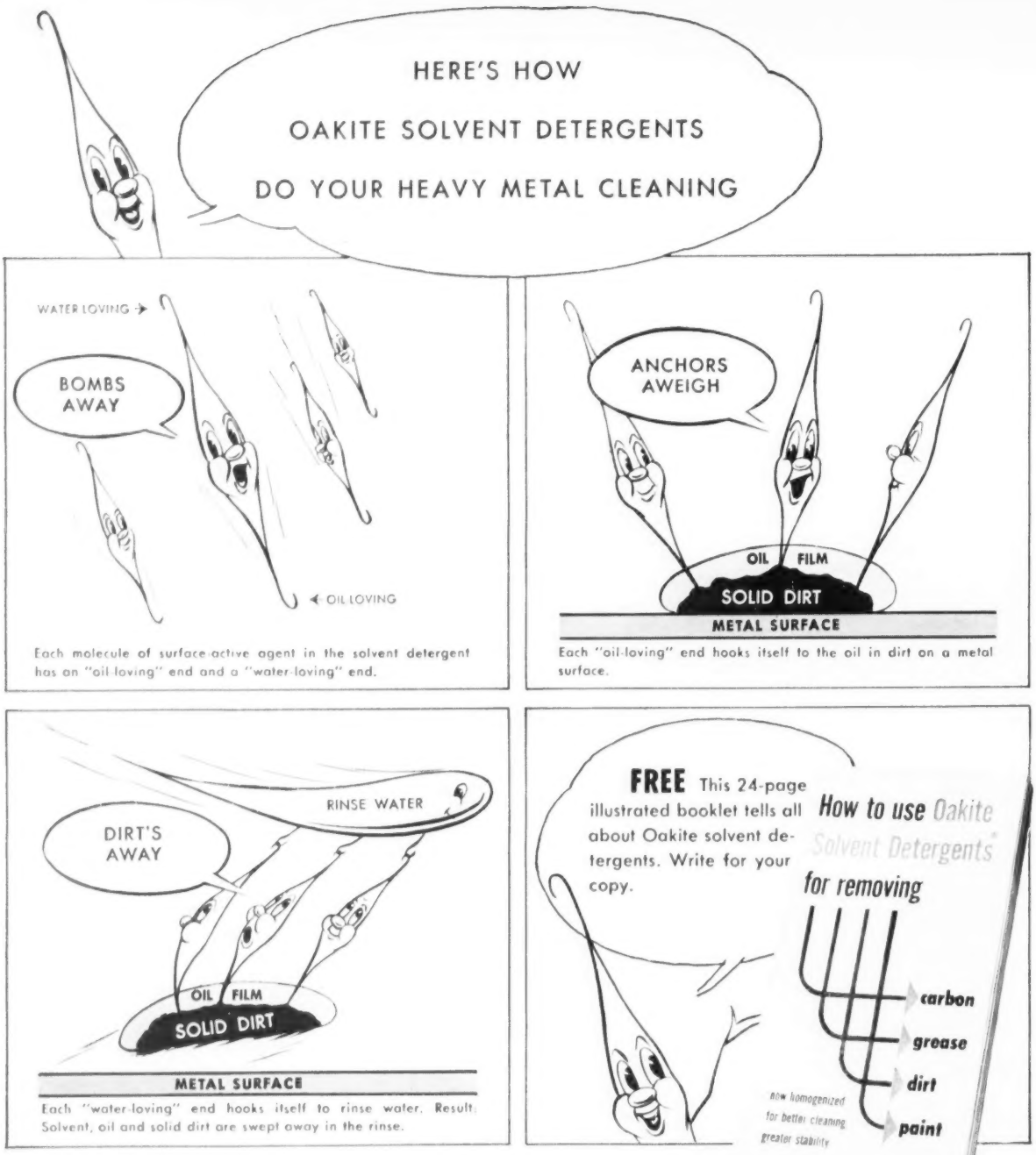

HERE'S HOW
OAKITE SOLVENT DETERGENTS
DO YOUR HEAVY METAL CLEANING
WATER LOVING
BOMBS AWAY
OIL LOVING
Each molecule of surface-active agent in the solvent detergent has an "oil-loving" end and a "water-loving" end.
ANCHORS AWEIGH
OIL
FILM
SOLID DIRT
METAL SURFACE
Each "oil-loving" end hooks itself to the oil in dirt on a metal surface.
DIRT'S AWAY
RINSE WATER
OIL
FILM
SOLID DIRT
METAL SURFACE
Each "water-loving" end hooks itself to rinse water. Result: Solvent, oil and solid dirt are swept away in the rinse.
FREE This 24-page illustrated booklet tells all about Oakite solvent detergents. Write for your copy.
How to use Oakite Solvent Detergents for removing
carbon
grease
dirt
paint
now homogenized for better cleaning greater stability
OAKITE PRODUCTS, INC.
19 RECTOR ST. NEW YORK 6, N. Y.

Oakite solvent detergents make it easy for you to remove heavy soils such as drawing and buffing compounds and thick deposits of other oils and greases.

Oakite solvent detergents may be used in spray washing machines or in tanks. They offer many advantages: speedy removal of stubborn soils, safety for all metals, economy, reduction of fire hazards, protection against rusting.

For the FREE booklet describing these splendid cleaners, precleaners and paint strippers, write to Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

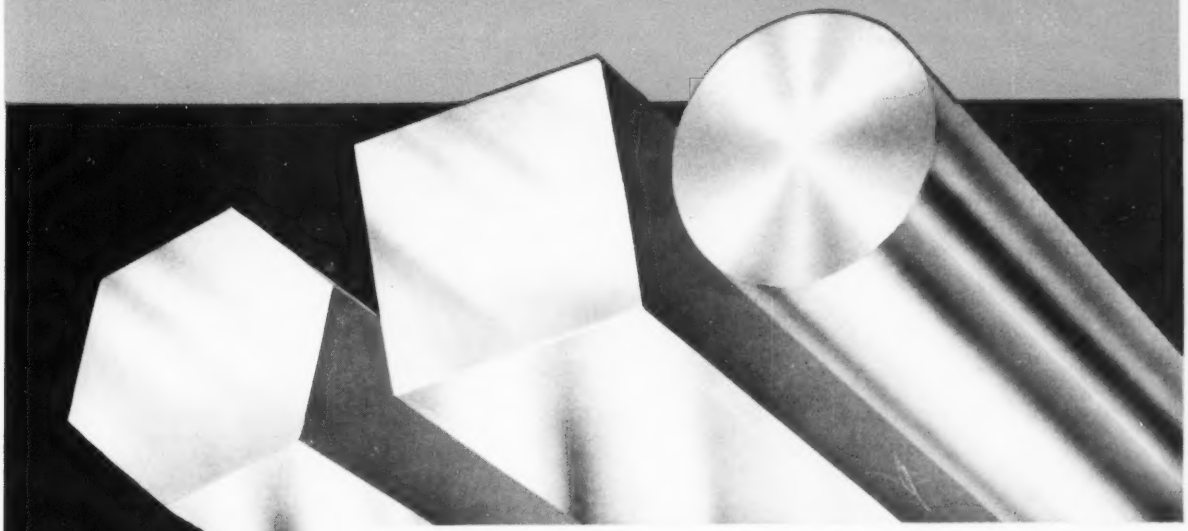
Technical Service Representatives in Principal Cities of U. S. and Canada

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

For more information on products advertised, use Inquiry Card, page 243

"J&L 1200"

COLD FINISHED CARBON STEEL



Use "J&L 1200" steel on your tough jobs for

tops in quality

tops in machinability

tops in uniformity

tops in finish

available in all standard shapes and sizes

gives you tops in quality at standard prices

"J&L 1200" Steel, another of the corporation's many Cold Finished *firsts* has proved itself in shops throughout industry. It has become a regular specification for their production runs. And, with good reason . . . "J&L 1200" Steel provides *quality results* at *standard* prices. "J&L 1200" series meets equivalent compositions published by the A.I.S.I. . . . S.A.E. . . . and Federal Specifications QQS-633.

Jones & Laughlin

STEEL CORPORATION — *Pittsburgh*

J&L STEEL

Send for this useful book ⇨

Jones & Laughlin Steel Corporation
Dept. 473, 3 Gateway Center, Pittsburgh 30, Pa.
Please forward a copy of your booklet, "J&L 1200" Cold Finished Steel.

Name .....

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To meet a human need . . .

We believe that the hands of America's workers are industry's most important tools. For this reason we are proud to introduce the **Scott Industrial Wiper,*** which is successfully meeting the wide range of wiping needs in industry. It is a general-purpose, disposable wiper designed to handle your jobs safely, efficiently and economically. A Scott man stands ready to demonstrate this product in your plant.

*PAT. PEND.

SCOTT PAPER COMPANY, CHESTER, PENNSYLVANIA

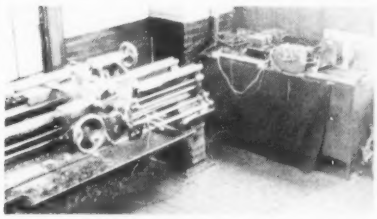
For more information on products advertised, use Inquiry Card, page 243

Now . . . Picture These Advantages for Your Tools and Dies!

Make this *3-Minute Check* . . . Discover what has been put into a *dependable* die steel to help you get better die performance, lower costs!

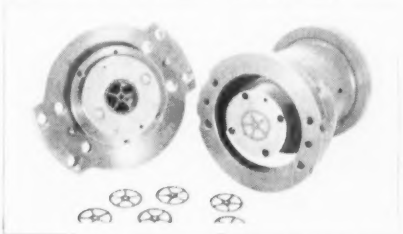
Improving existing die steels and developing new ones to meet the need for lower production costs, has been a challenge met by Carpenter. The results are modern die steels that heat treat and machine easier to save time and money; run longer between grinds to reduce unit costs. Here are facts about *Stentor* (Oil-Hard) Die Steel . . . one of 12 modern steels in Carpenter's well-known Matched Set. Check what *Stentor* offers . . . compare it point by point with the die steel you now use. We believe you'll agree: Here is a real opportunity to put your tooling ahead of competition, take a big step to high quantity output at reduced unit costs.

Here is what *Stentor* gives you . . . *COMPARE* it with the die steel *you* use . . .

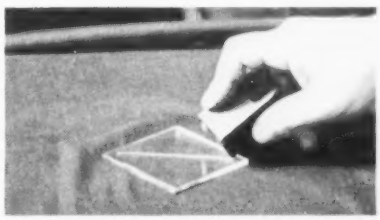


Easy Machinability. Two steels were put through this machining test. One, a well-known oil-hardening tool steel; the other, *Stentor* with its simplified analysis. Bars tested were 3½" rd. with same Brinell hardness and structure. Result: With a cut .020" deep, *Stentor* proved to be 11% easier to machine than the other steel. Does the steel you use provide this *extra economy* in machining?

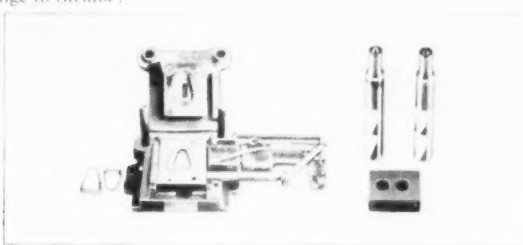
Simplified Heat Treating. Because of *Stentor's* simplified analysis, it hardens from the low temperature of 1420° to 1450°F. This low temperature reduces dangers of size change and decarburization—holds warpage to an absolute minimum. How does the steel you use compare with this?



Safety and Accuracy in Hardening. This punch and die blanks 1.342" dia. timing mechanism gears having 120 teeth/90 pitch, made from 24 ga. ¾-hard brass. Customer reports: "In heat treatment the *Stentor* die moved only .0005" on the max. dia. of the gear." If the oil-hardening steel you use doesn't behave like this, it's time to change to *Stentor!*



Freedom from Decarburization. Here is a *Stentor* part as quenched and before drawing, showing absence of soft skin. This test proves that *Stentor* tools when properly hardened are hard enough, right on the surface, to scratch glass! Does the steel you use give you this *positive* freedom from decarb?



Full Dependability in Service. Here are just two examples of the job *Stentor* does day after day in service. Die on left gave *83 continuous* hours of production between grinds compared to *10 hours* with a chrome-tungsten grade! The ¼" dia. punches shown to right above punch ¼" thick SAE 1020 steel. After *Stentor* was used production went up 160%. How much *more* output could you add to your total with *dependability* like this?

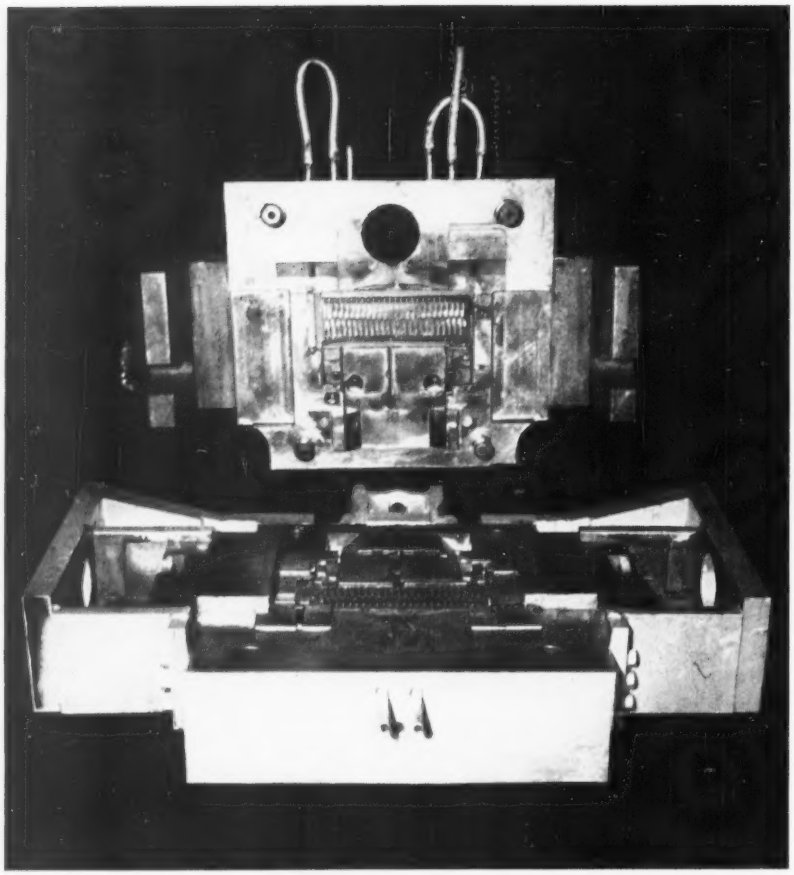
If you are not getting *all* of these advantages from the steel you use, you're missing a big opportunity to cut costs, raise output!

change to *Carpenter*

Matched Tool and Die Steels

***. . . modern* die steels engineered to meet *today's* requirements!**

The Carpenter Steel Company, 105 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N.Y. "CARSTEELCO"
Get Immediate Delivery . . . Call your Carpenter Mill-Branch Warehouse, Office or Distributor



No matter what your DIE-CASTING JOB may be...

Accuracy calls for POTOMAC M Hot Work Die Steel

"HOT-WORK STEELS"

is the title of a new, six-page folder that tells about the chromium, molybdenum, vanadium Hot Die Steel known as POTOMAC M—and also covers other grades for other hot-work operations. Secure your copy —*write today!*

ADDRESS DEPT. M-50

In the precision casting of aluminum, POTOMAC M Hot-Work Die Steel is especially favored as the material for die-casting dies because its properties help assure accuracy of the steel itself *after* heat treatment. Die makers have found that size changes are held to a minimum. Dimensional stability is thus the *first* contribution that POTOMAC M makes to accuracy.

Production accuracy of the die after it is in service is maintained also by the resistance of POTOMAC M to wear, to heat checking, and to metal wash.

Allegheny Ludlum makes a complete line of steels for hot-work tooling of various kinds—so, whether your need is the mass producing of duplicate parts or fabricating a few of them, call up or write "A-L" every time for hot-work counsel or service or both. Just tell us your requirements.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

For complete **MODERN** Tooling, call

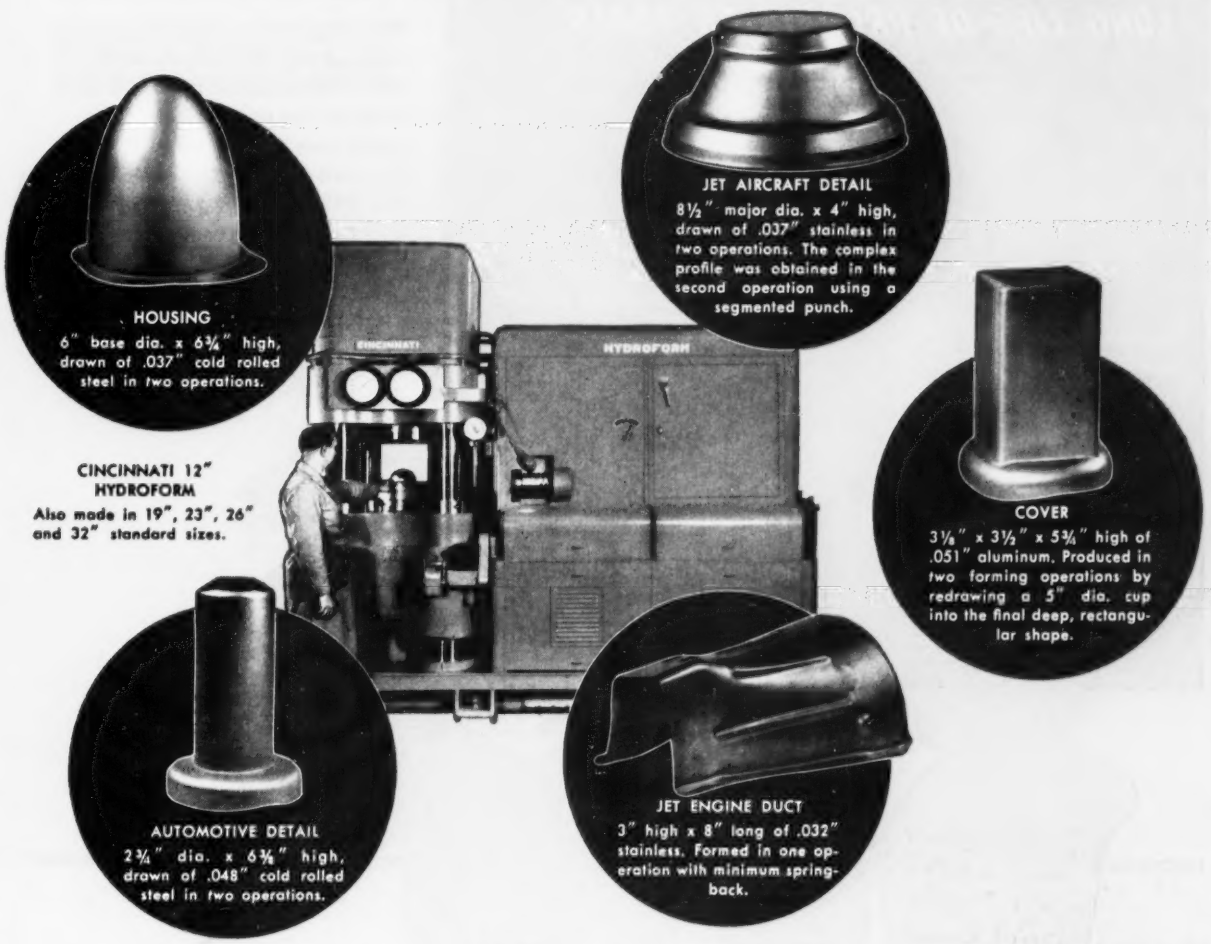
Allegheny Ludlum

W&D 3724

AL FINE TOOL STEELS SINCE 1854

For more information on products advertised, use Inquiry Card, page 243

When the draw is difficult . . . or the tool cost per unit is excessive . . .


HOUSING
6" base dia. x 6¾" high, drawn of .037" cold rolled steel in two operations.
JET AIRCRAFT DETAIL
8½" major dia. x 4" high, drawn of .037" stainless in two operations. The complex profile was obtained in the second operation using a segmented punch.
CINCINNATI 12" HYDROFORM
Also made in 19", 23", 26" and 32" standard sizes.
COVER
3⅛" x 3½" x 5¾" high of .051" aluminum. Produced in two forming operations by redrawing a 5" dia. cup into the final deep, rectangular shape.
AUTOMOTIVE DETAIL
2¾" dia. x 6⅜" high, drawn of .048" cold rolled steel in two operations.
JET ENGINE DUCT
3" high x 8" long of .032" stainless. Formed in one operation with minimum springback.

then use Hydroforming

Each of the parts shown above represents a difficult drawing job made *easy* by *Hydroforming*. No more than *two forming operations* were required to produce any one part.

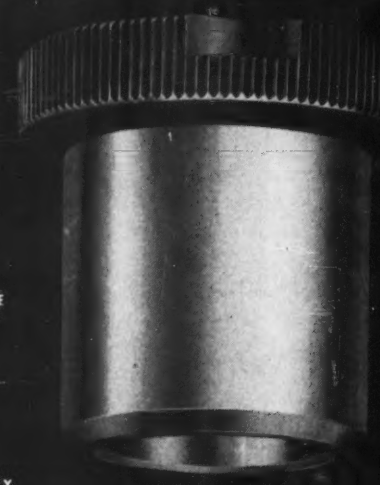
The combination of the Hydroform's ability to draw intricate or difficult shapes in fewer operations than conventional methods permit . . . plus the use of simple tooling that cuts toolmaking time to a day or two, instead of requiring weeks or months . . . made possible *quick* deliveries of these parts at *reasonable* unit costs.

Can you utilize these Hydroforming advantages to make your manufacturing methods more efficient—more economical? Call in a Cincinnati Milling field engineer. Let him give you complete information. Bulletin M-1759-2 supplies data on the Hydroforming process as well as machine specifications. Write for your copy.

CINCINNATI Hydroform **THE CINCINNATI MILLING MACHINE CO.**
CINCINNATI 9, OHIO, U.S.A.

UNIVERSAL DRILL BUSHINGS

INSURE PERFECT ALIGNMENT AND LONG LIFE OF PRODUCTION TOOLS

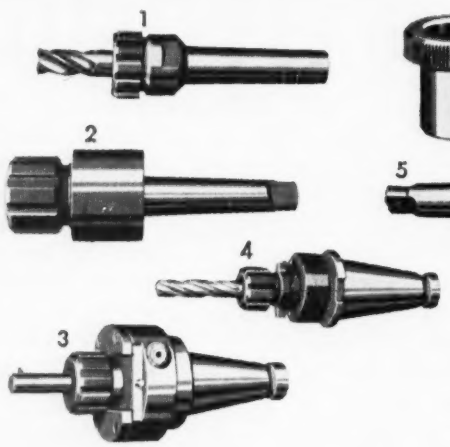

SUPERFINISH BORES REDUCE TOOL WEAR
KNURLED HEADS PROVIDE GOOD GRIP
100% CONCENTRICITY AND HARDNESS TESTS INSURE ACCURACY
BLENDED RADIUS HELPS PREVENT TOOL HANG-UP

Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.

181

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2
MICHIGAN



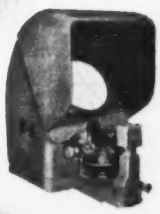
1	STANDARD COLLET CHUCK
2	FLOATING COLLET CHUCK
3	BORING CHUCK
4	"KWIK-SWITCH" TOOL HOLDER
5	MIKRO-LOK BORING BAR
6	STANDARD DRILL BUSHING
7	UNIVERSAL INDEX PLUNGER

For more information on products advertised, use Inquiry Card, page 243

11 MODELS

3 SCREEN SIZES

Pedestal Type
14" Diam. Screen



Bench Type
14" Diam. Screen
4 Models

Bench Type
5¾" x 7¾" Screen
3 Models

Unsurpassed Inspection Versatility

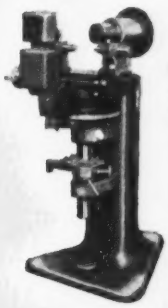
JONES & LAMSON OPTICAL COMPARATORS

The Essence of Quality Control

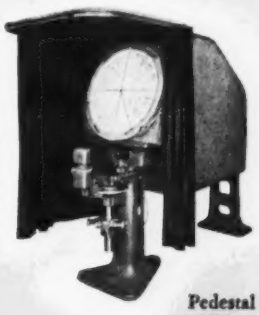
Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- **They meet** the requirements of toolroom, laboratory and production inspection.
- **They precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- **They compare** intricately contoured parts with a master outline—and measure the amount of error.
- **They are convenient** to operate, easy to set up and read direct—*without computation.*
- **They operate** under normal lighting conditions. *No darkroom is needed.*
- **They will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- **They will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.

Vertical Type
14" Diam. Screen



Direct
Projection
Type



Pedestal Type
30" Diam. Screen

P.S. A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE COMPANY
512 Clinton St., Springfield, Vt., U.S.A.

J&L **COMPARATOR DIV.**
Dept. 710

Jones & Lamson Machine Company
512 Clinton Street, Dept. 710
Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME_____ TITLE_____

COMPANY_____

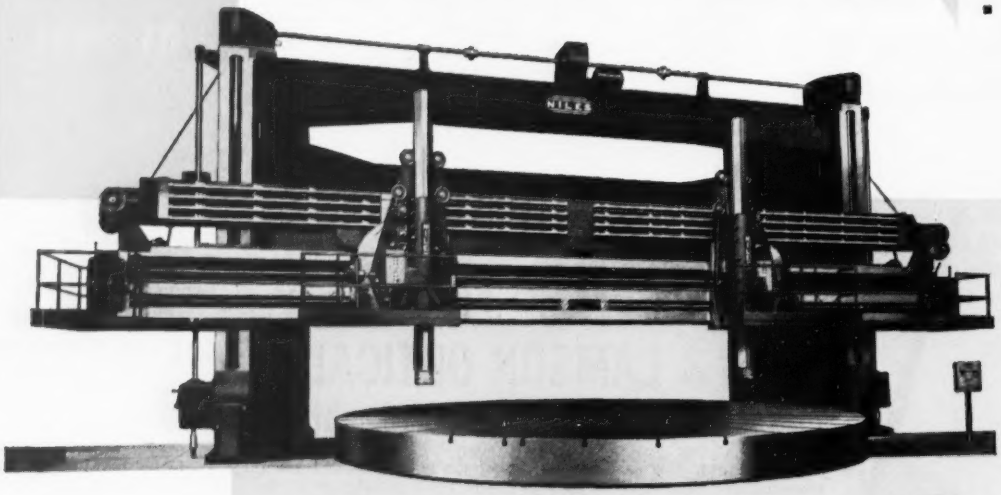
STREET_____

CITY_____ STATE_____

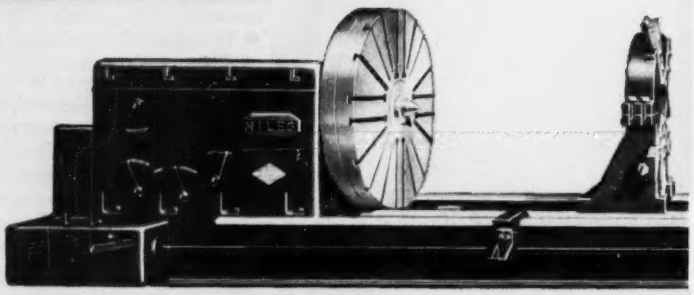
For more information on products advertised, use Inquiry Card, page 243

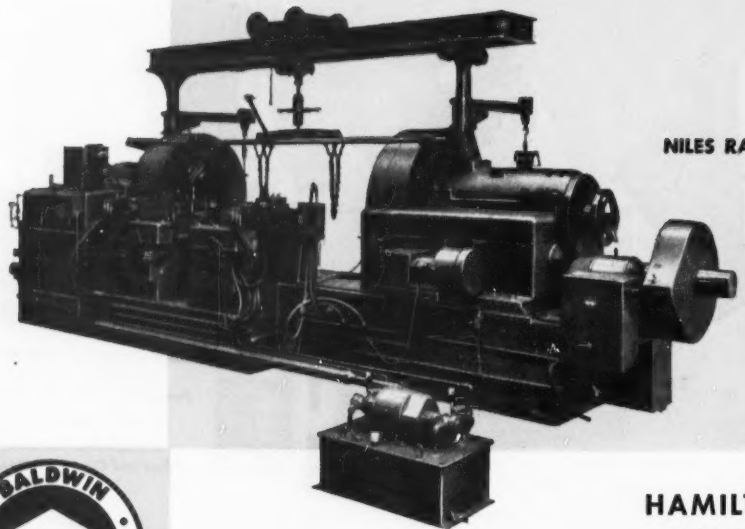
B-L-H MACHINE TOOLS

designed
. . . built



NILES VERTICAL BORING AND TURNING MILLS— 10' 12' 14' 16' 20' 30' and 43' *(shown above)*





NILES RAILROAD TOOLS— Hydraulic Car Wheel Lathe (at left); End Drive Axle Lathe; Hydraulic Centering Machine; Hydraulic Diesel and Car Wheel Borers; Hydraulic Axle Burnishing Lathe

HAMILTON WORKS
HAMILTON, OHIO

BALDWIN - LIMA

for modern speeds and automation

ruggedly for lasting precision

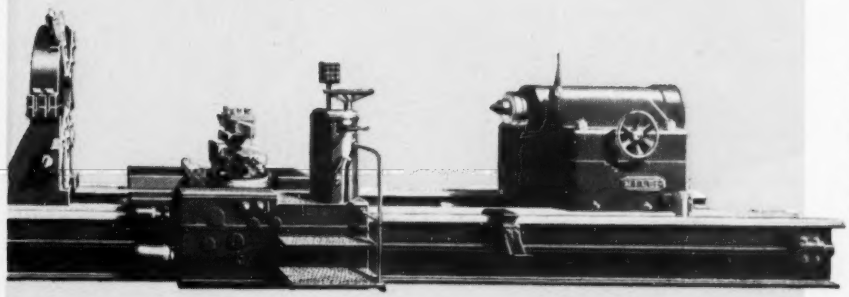
NILES

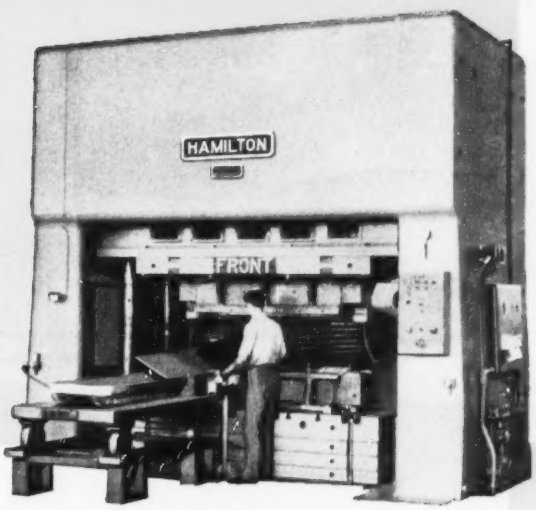
BORING MILLS
ENGINE LATHES
RAILROAD TOOLS

HAMILTON

MECHANICAL PRESSES

NILES HEAVY ENGINE LATHES—
40", 50", 60", 72", 84", 96" and larger sizes





HAMILTON MECHANICAL PRESSES—
single, double and triple action presses for metal forming and stamping; also open back inclinable presses, rail presses, welding presses and die fitting machines.

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Phone—Trinity 5-9154

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642 Wyatt Bldg.
Phone—Executive 3858

PITTSBURGH 19, PA.
643 Union Trust Bldg.
Phone—Atlantic 1-4896

NEW YORK 17, N. Y.
60 E. 42nd St.
Phone—MUrray Hill 2-4747

AGENCIES

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Quinn & Quinn
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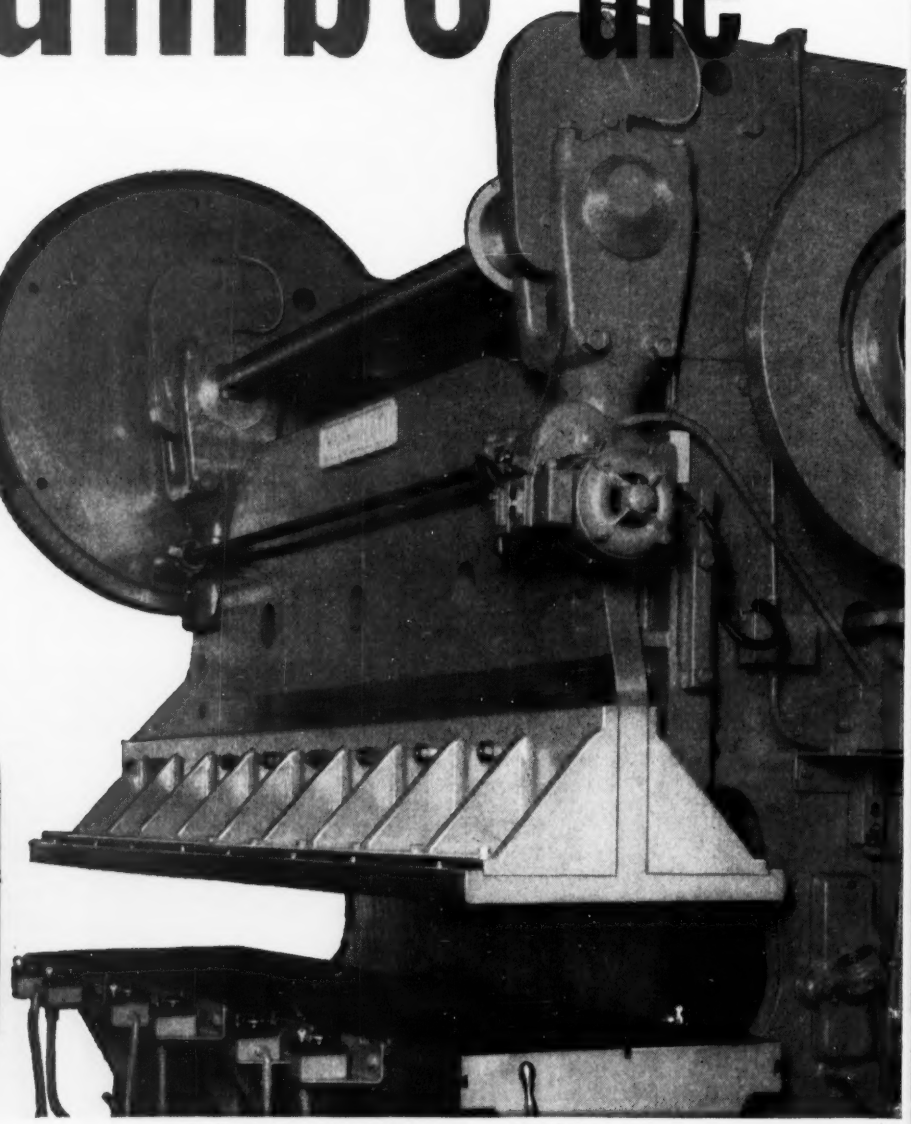
For full information on these B-L-H Machine Tools see our 12-page catalog in Sweet's Machine Tool Catalogs . . . or

***Write* us for your free copy.**

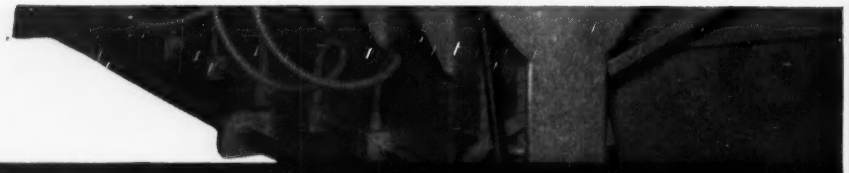
- HAMILTON

Jumbo die

• Short, special purpose, removable upper brackets.



• Large area, removable upper brackets.



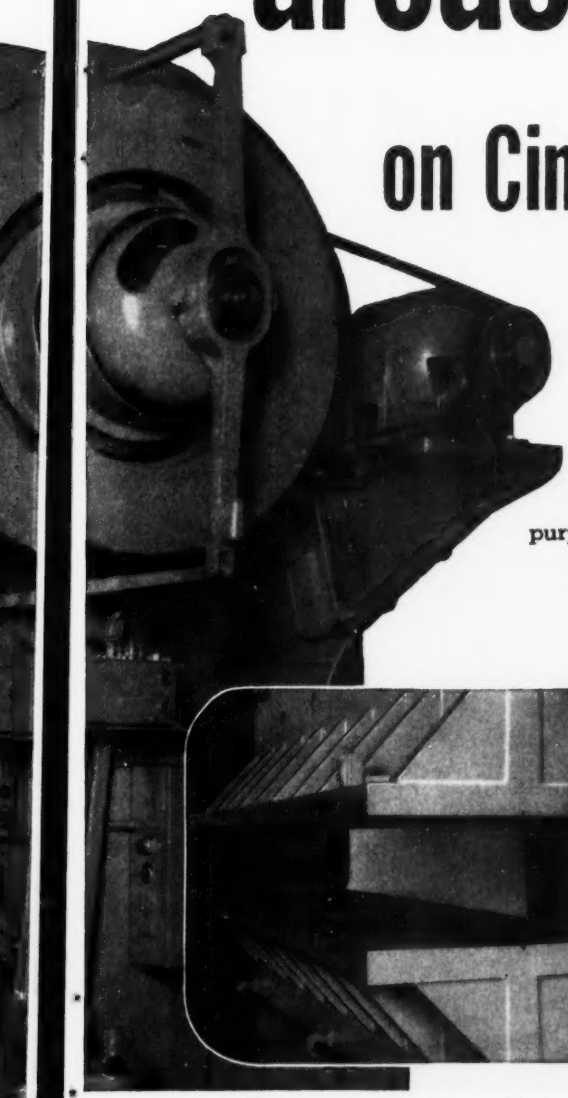
CINCINNATI

THE CINCINNATI SHAPER CO.

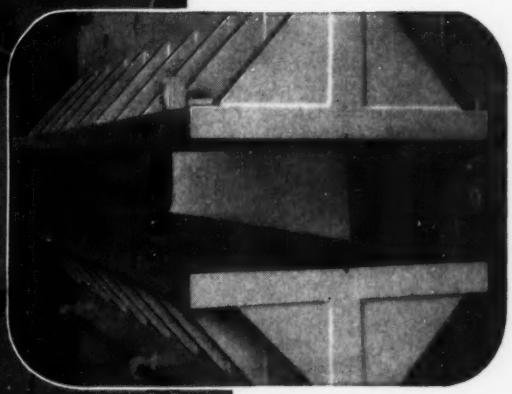
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

areas . . .

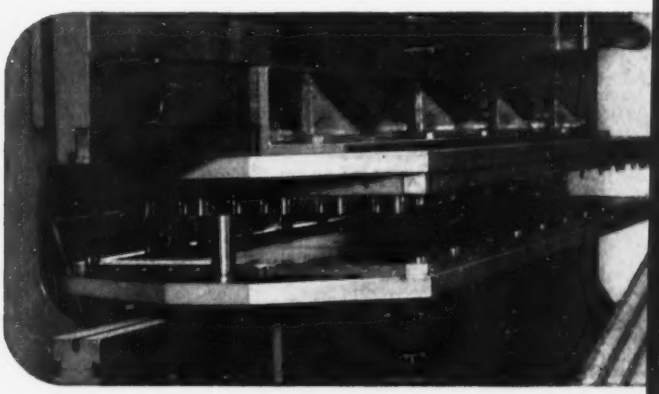
on Cincinnati Press Brakes



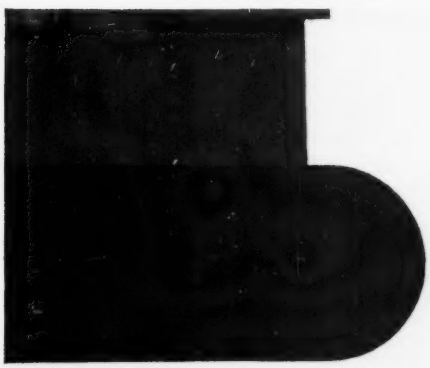
More and more jobs are being done on versatile Cincinnati Press Brakes. Removable or fixed brackets with large die areas permit many jobs to be done both in the Press Brake and Press fields. When dual purpose performance is required removable brackets are used—for Press work only, fixed brackets are furnished. Brackets are designed to sizes desired.



• Large area, permanent wide bed and ram for press work.

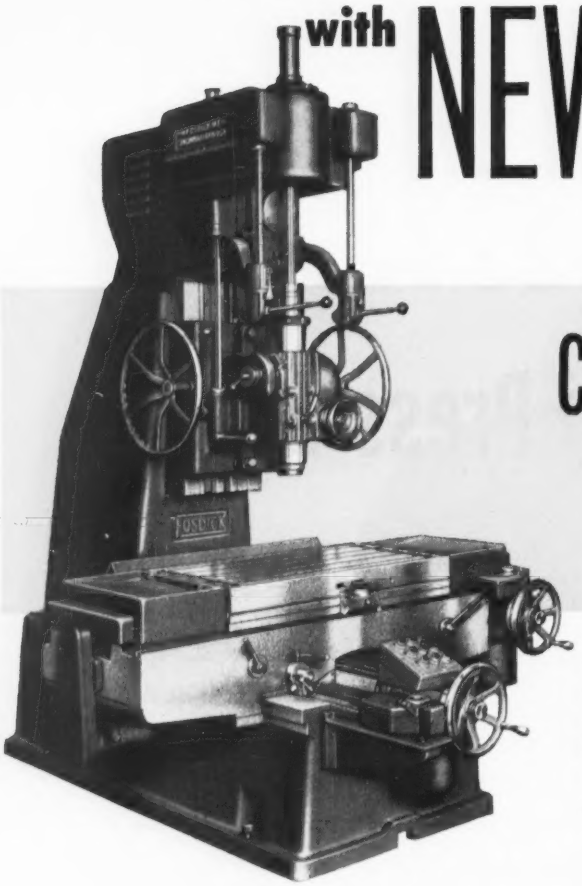


• Large area, removable upper and lower brackets.



Investigate! Our Engineering Department will be glad to advise you on the profit and production possibilities in your shop. Write for Catalog B-4.

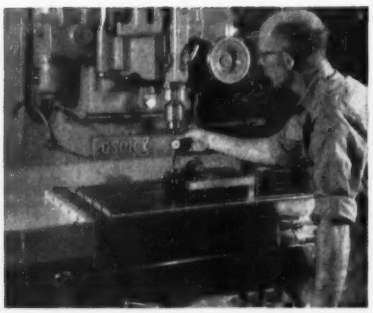
with NEW Fosdick BF Spindle



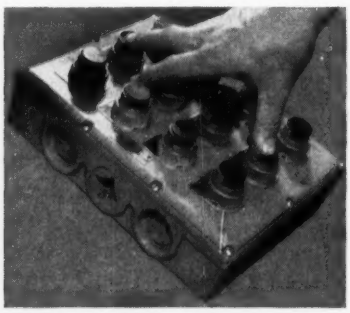
change boring tools repeat hole size

No more "cut and try" resetting of boring tools every time you change them! With the new BF Spindle you can change tools in seconds with such accuracy that hole sizes are repeated within ± .0001", *without* resetting. Slash time drastically, whether boring a "one-shot" jig with many different size holes or producing work where repetitive precision is essential.

Fast tool changing with Automatic Positioning for High-Speed, Precision Boring to a NEW Degree never before obtainable.



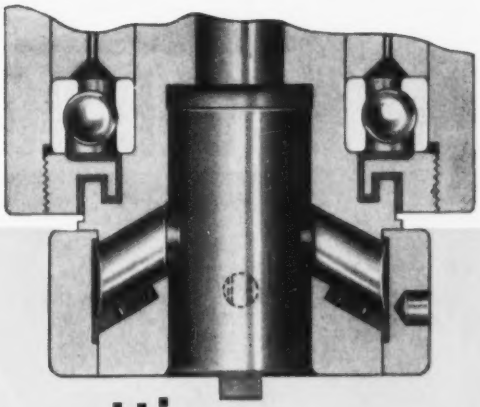
Drop duplicating bars in place—position work for first hole and bore. Then . . .



PRESS the button—and in the twinkling of an eye—you're positioned within ± .0001" for the next operation.

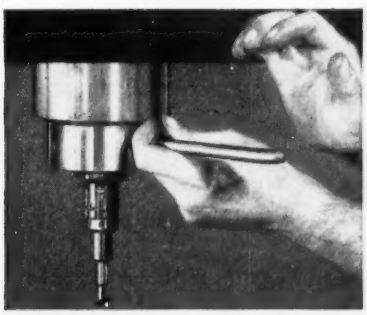
Fosdick builds Automatic Positioning into its Jig Borers to give you ± .0001" table positioning *in seconds* simply by pressing a button – even with inexperienced operators. Only two easily-made, easily-stored duplicating bars are needed for each job. Once bars are set, work initially positioned, press button and, in seconds, you're ready for the next operation! This is Fosdick's precision combination – *One hole or a thousand, same size or different, you'll hold both position and hole size to ± .0001"!*

For more information write for these bulletins: Fosdick Jig Borer .. Bulletin 42 M Automatic Positioning ..... Bulletin 42 P M BF Spindle Bulletin B F M



in seconds... to ±.0001" without resetting

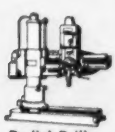
High-precision tool holder is built integral with Jig Borer spindle. Straight-shank tool adapters fit holder precisely – wipe surface clean as tool is inserted, keep dust and dirt from upsetting precision fit. Both adapters and tools "keyed-in" for identical repositioned accuracy.



With the BF Spindle, you can change boring tools while the machine positions. Simply loosen cam ring with spanner wrench. Further hand rotation releases tool.

Then insert new tool, tighten cam ring and you have Fosdick's precision combination—tool changing and work positioning both to ± .0001" in a matter of seconds!

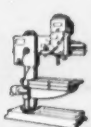
Need Drilling Equipment? Get a Proposal from Fosdick!



Radial Drills

Jig Borers

Sensitive and Upright Drills

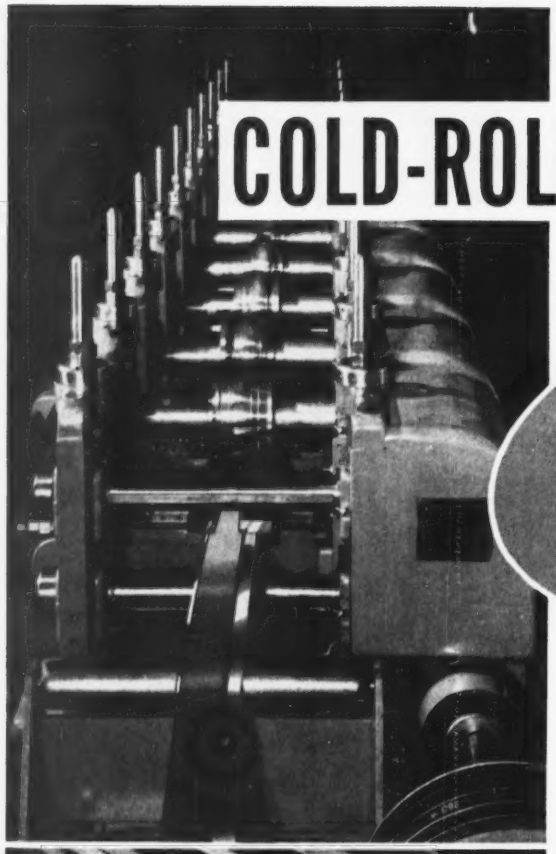


Sensitive Radial Drills

Automatic Positioning Machines

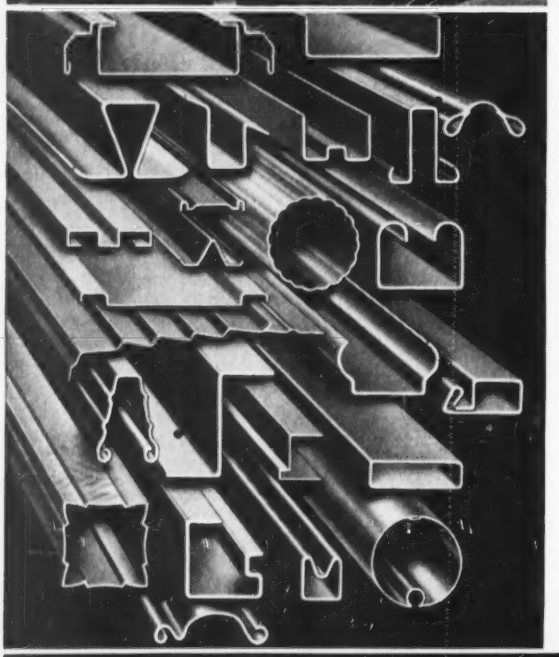
FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO



COLD-ROLL FORMING...

a CHALLENGE and a PROMISE



Cold Roll Forming holds a perpetual challenge to your skill and ingenuity in devising new ways to step up production and reduce cost. Infinite possibilities are suggested by thousands of existing applications in the high-production metal working industries.

New applications are constantly being discovered. Total production of Yoder cold roll forming machines now runs into billions of feet annually.

A Yoder roll forming machine can be arranged for doing other operations, such as notching, embossing, perforating, curving, coiling, welding, etc., at little or no extra labor cost. Yoder engineers are at your service in designing such multi-purpose production lines.

The Yoder Book on Cold Roll Forming discusses its varied functions and advantages, with scores of photos illustrating end uses of roll formed products. Ask for it.

THE YODER COMPANY
5504 Walworth Ave. • Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

For more information on products advertised, use Inquiry Card, page 243

We acknowledge with deep gratitude your faith and continued cooperation since 1904.

THE SIDNEY MACHINE TOOL COMPANY

50th Year

of service to

AMERICAN INDUSTRY

1904 • 1954

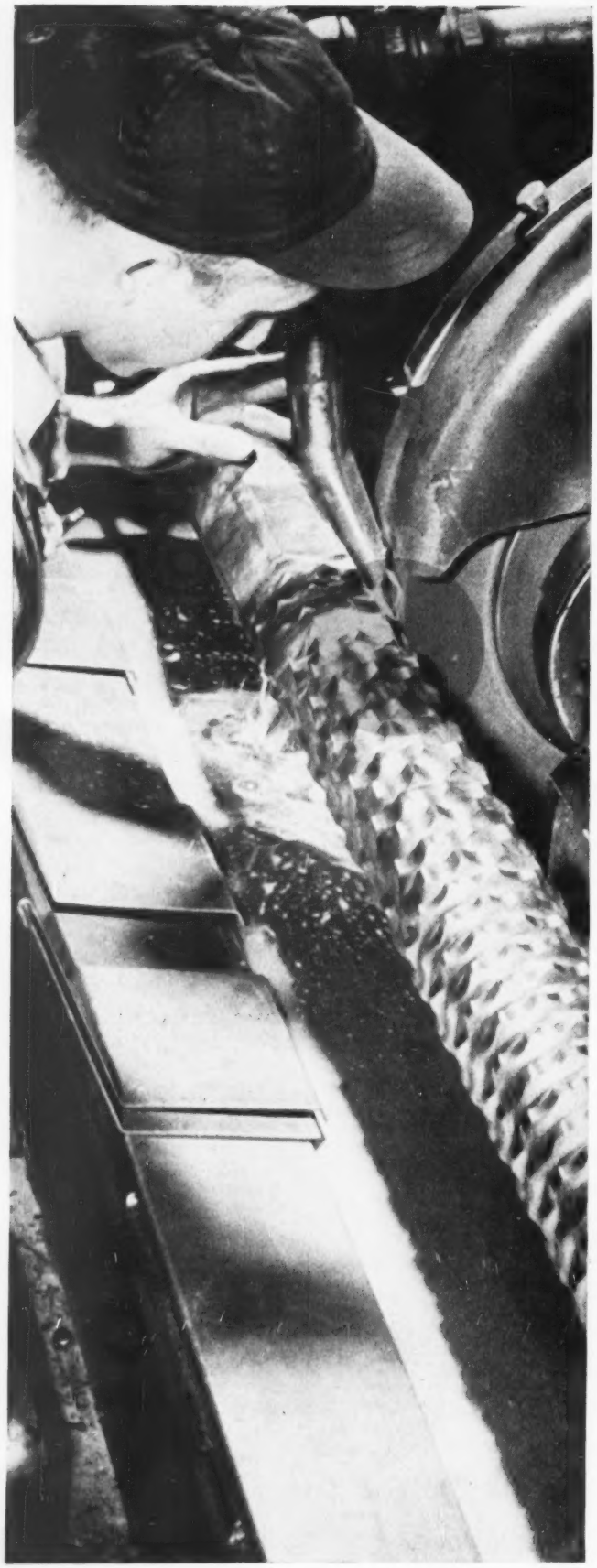
SIDNEY • OHIO

We shall endeavor to merit your confidence in the future as in the past.

THE SIDNEY MACHINE TOOL CO.

Builders of Precision Machinery since 1904

SIDNEY, OHIO



PROOF that O.D. grinding gets the "TOUCH of GOLD" with Norton G BOND wheels

. . . "Gave more than three times as many pieces per dressing."

. . . "Requires less truing and lasts 30 per cent longer."

. . . "Free cutting, excellent finish, considerably reduced grinding time."

. . . "Formed easily, held shape and removed .078" per plunge cut."

"Best Wheel Ever Used," reported by a user of Norton G Bond Wheels for cylindrical grinding, sums up the industry-wide verdict.

Reports like these are coming in fast from our O. D. grinding customers using Norton G Bond wheels. Throughout the entire range of cylindrical and centerless grinding jobs these new wheels are chalking up truly sensational records for more units per dressing, per hour and per wheel.

That's because the new G Bond, especially designed for precision and semi-precision grinding, is the most efficient vitrified bond ever developed. Wheels made with it are assured of constant, fresh, sharp cutting surfaces because of its unique ability to hold each abrasive grain *just long enough* for maximum cutting action.

Advantages That Pay Off

When you, too, try G Bond wheels you'll find they cut cooler . . . remove material faster . . . produce a better finish . . . produce more pieces per dressing . . . hold shape longer . . . and crush-true more easily. Then you'll know you've added the real production-boosting, cost-reducing "Touch of Gold" to every O. D. grinding job you do.

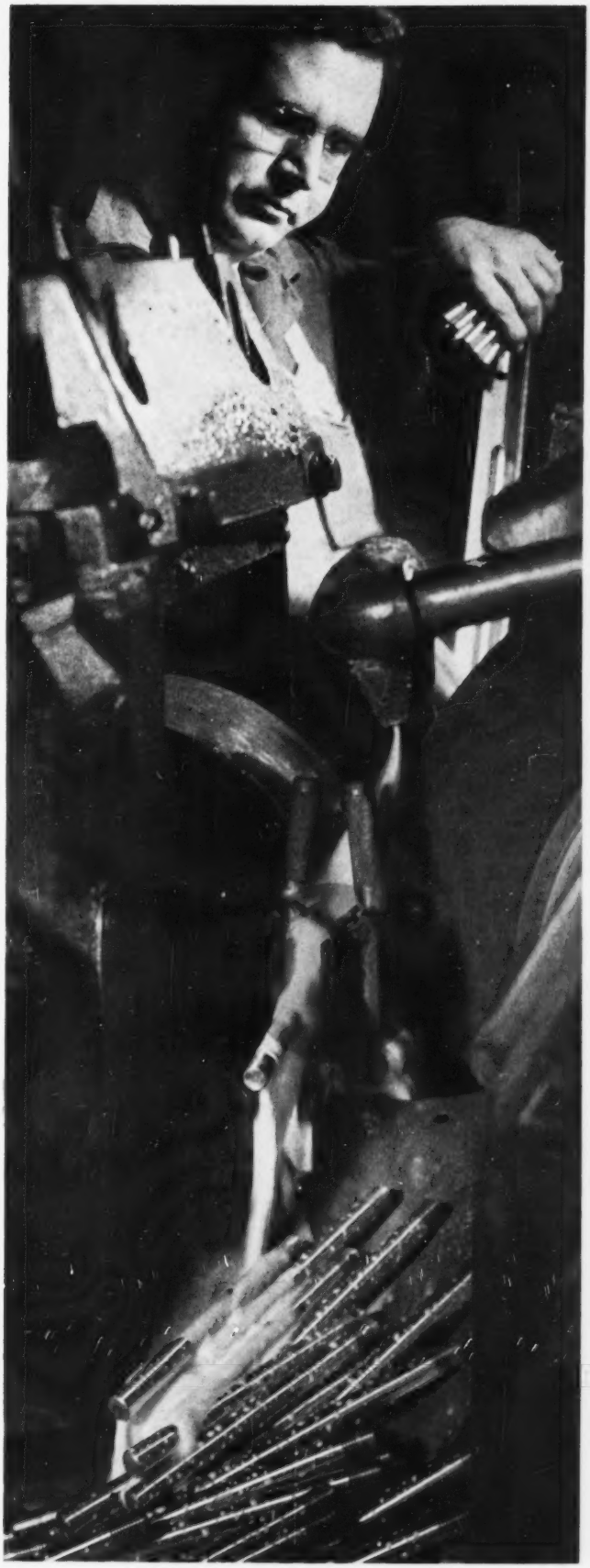
Ask Your Norton Distributor

for on-the-job proof of what G Bond wheels can do for your O. D. grinding. He'll gladly arrange a test in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities — listed under "Grinding Wheels" in your telephone directory yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1510

NORTON
ABRASIVES

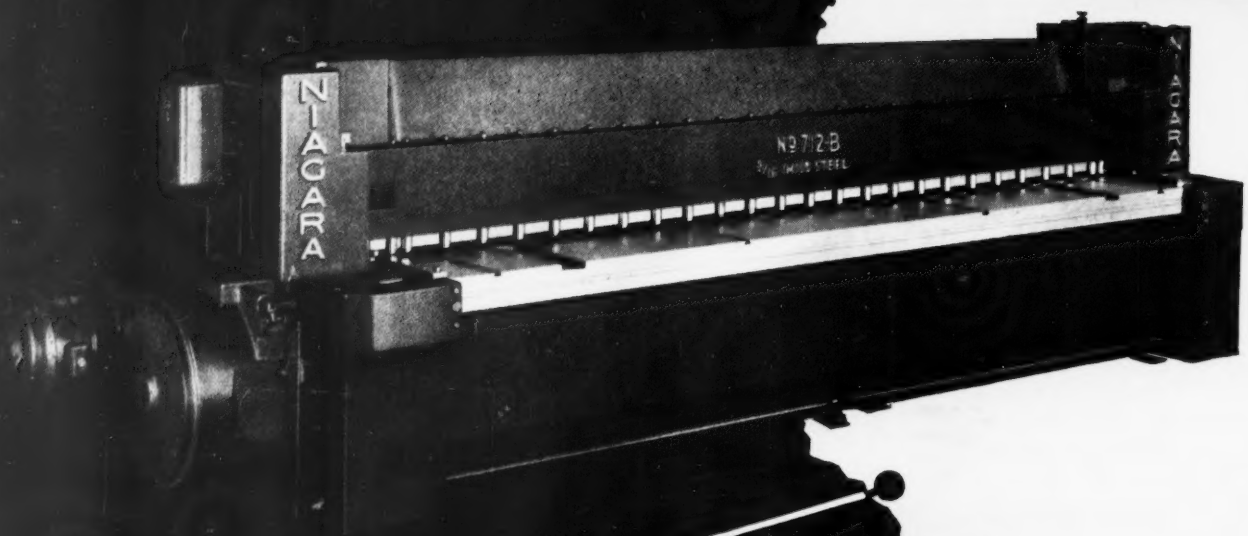
Making better products...
to make other products better

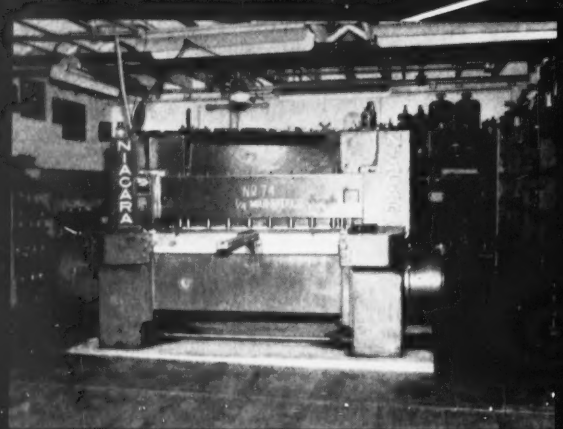


"G Bond Wheels Cut Faster, with twice as many pieces per dressing," says a customer reporting on a centerless grinding application.

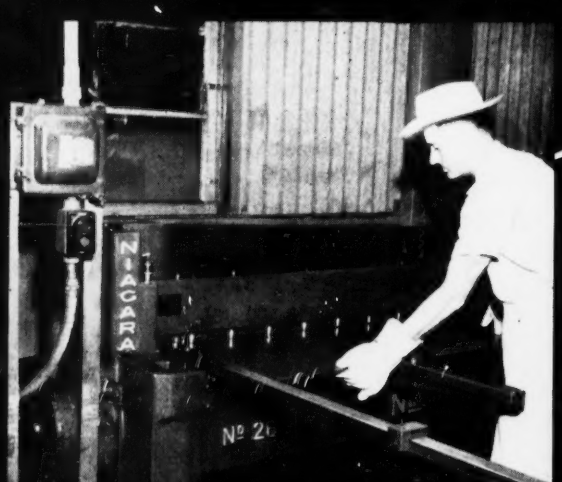
NIAGARA

SERVE INDUSTRY FROM





ELECTRONICS. Cutting .003" molybdenum to within .001" and ¼" copper with no change in set-up at a plant in California



DRUMS. Shearing sheets for drum bodies in Texas

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

SHEARS
COAST TO COAST

* For high volume shearing applications, Niagara shears are preferred because of their:

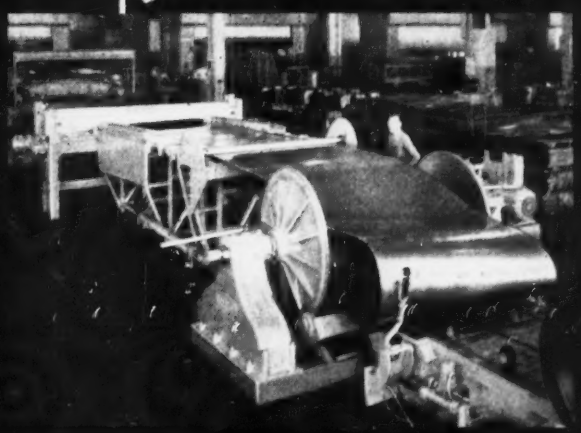
DEPENDABILITY
ACCURACY
LOW MAINTENANCE COST

A few typical installations are illustrated

Niagara builds more than 80 different sizes and capacities of squaring shears . . . one to suit every requirement of production, maintenance or warehousing.

ELEVATORS. Two of seven Niagara Shears in production at a large plant in New Jersey

WAREHOUSE. Shearing thousands of tons of all kinds of steel at a steel warehouse in Michigan

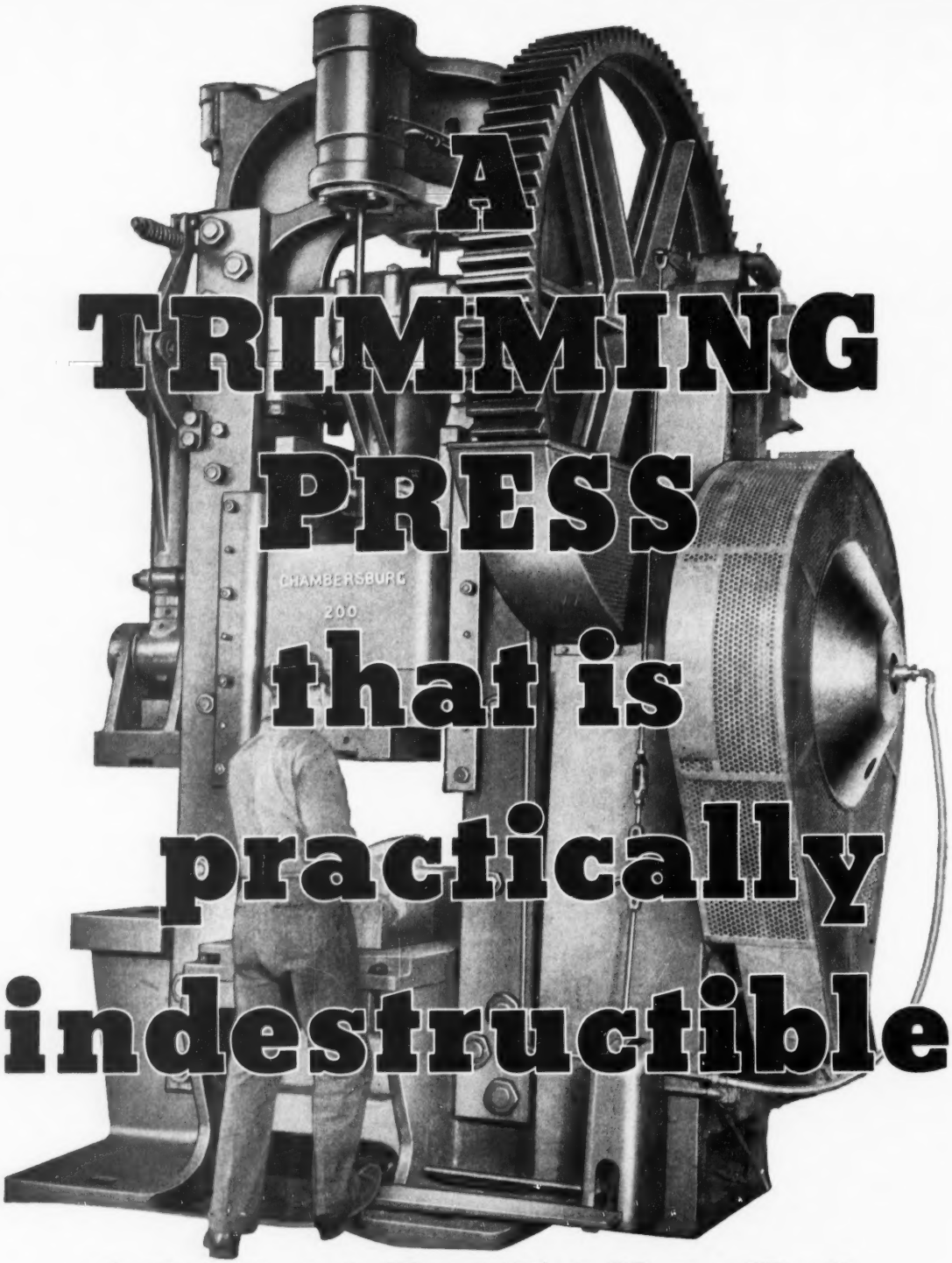


AUTOMOBILES. Continuous operation in a cut off line at a body plant in Western New York

America's Most Complete Line of Presses, Shears, Machines and Tools for Sheet Metal Work

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries



A TRIMMING PRESS that is practically indestructible

CHAMBERSBURG

THE HAMMER BUILDERS

CHAMBERSBURG ENGINEERING CO.

Builders of THE IMPACTER

"FORGING IN MID-AIR"

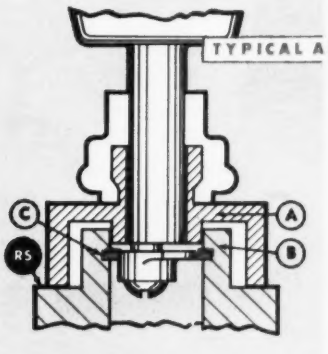
CHAMBERSBURG, PENNSYLVANIA

For more information on products advertised, use Inquiry Card, page 243

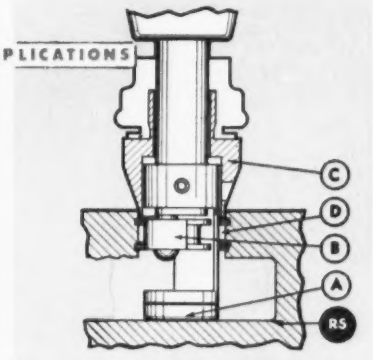
Waldes Truarc Grooving Tool Out-Performs Conventional Recessing Tools

SAVES TIME! CUTS COSTS! NEEDS NO SKILLED LABOR!

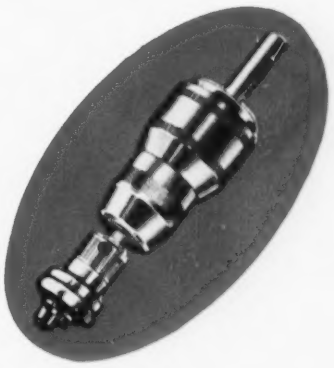
TYPICAL APPLICATIONS

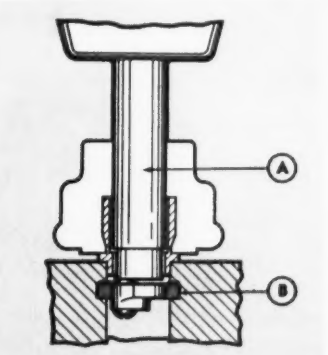


Clearing Obstructions or Protrusions — Waldes Truarc Grooving Tool with *special bushing* with high shoulder A in order to clear obstruction B on reference surface RS so groove can be properly located in bore.

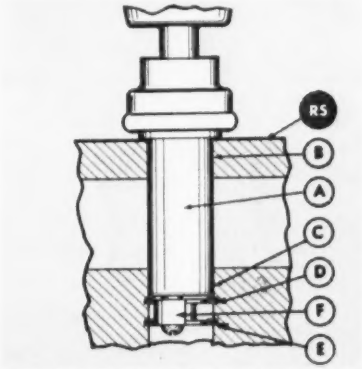


Locating Grooves from Bottom of Hole or Blind Hole—Use of *bottom adaptor* A and double cutter B. Bushing C pilots tool into bore D while bottom adaptor acts as stop to locate grooves from reference surfaces RS below bore.





Small Diameter Bore — Need for Wide Groove — Great versatility of tools allows A-2 Tool to accept *stepped down spindle* and *cutter-shaft* assembly A. Provides cutting capacity in a bore normally within the range of smaller A-1 Tool. Illustrated, larger tool capacity necessary to cut groove diameter B exceeding normal capacity of standard A-1 Tool.



Extending Reach of Tool — Waldes Truarc Grooving Tool assembled with *extended bushing* A increases normal range of tool in order to reach proper groove location in bore. Bushing also registers on reference surface RS of workpiece while piloting tool at two points B and C inside bore. Two grooves D and E are cut simultaneously with double cutter F.

AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.000 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEM TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.

WRITE NOW FOR 20 PAGE TECHNICAL MANUAL CONTAINING FULL ENGINEERING DATA

WALDES

TRUARC

Reg. U. S. Pat. Off.

GROOVING TOOL

MADE BY THE MANUFACTURERS OF WALDES TRUARC RETAINING RINGS.

WALDES KOHINOOR, INC., 47-16 Austel Pl., L. I. C. 1, N.Y. Waldes Truarc Grooving Tool mfd. under U. S. Pat. 2,411,476

MO26

Waldes Kohinoor, Inc., 47-16 Austel Place
Long Island City 1, New York

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

Name_____

Title_____

Company_____

Business Address_____

City_____ Zone____ State_____

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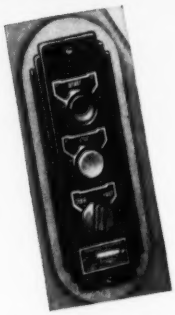
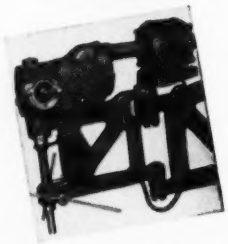
FOOTBURT

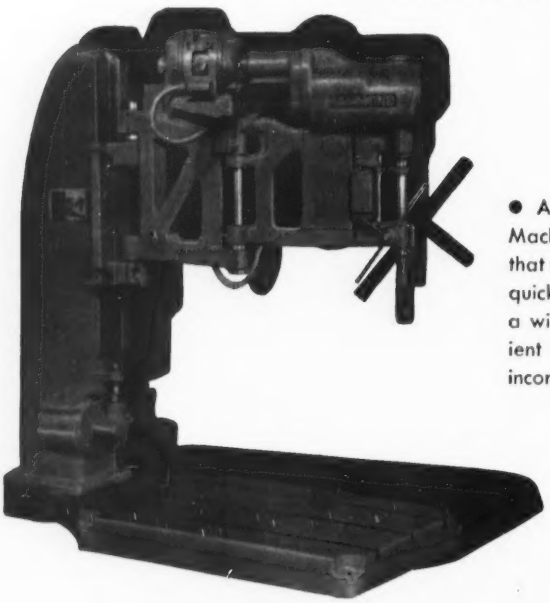
machine tools
for *increased*
production



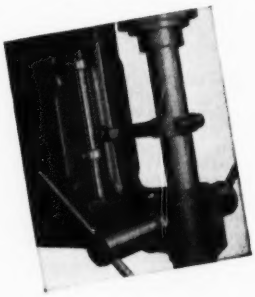
● Here is a machine designed to perform light drilling and tapping operations at high speed with minimum of effort. Any one of six spindle speeds may be quickly selected and tapping is always instantly available without any adjustments to the machine. It makes an excellent choice for miscellaneous work on a large layout of varying size holes.

THE FOOTE-BURT COMPANY, Cleveland 8, Ohio
Detroit Office: General Motors Building





● A Unique Radial Drilling Machine with Hinged Bracket that makes it possible to swing quickly from hole to hole over a wide area. A very convenient tapping arrangement is incorporated in this machine.



☆engineered for production

FOOTBURT

MACHINE TOOLS

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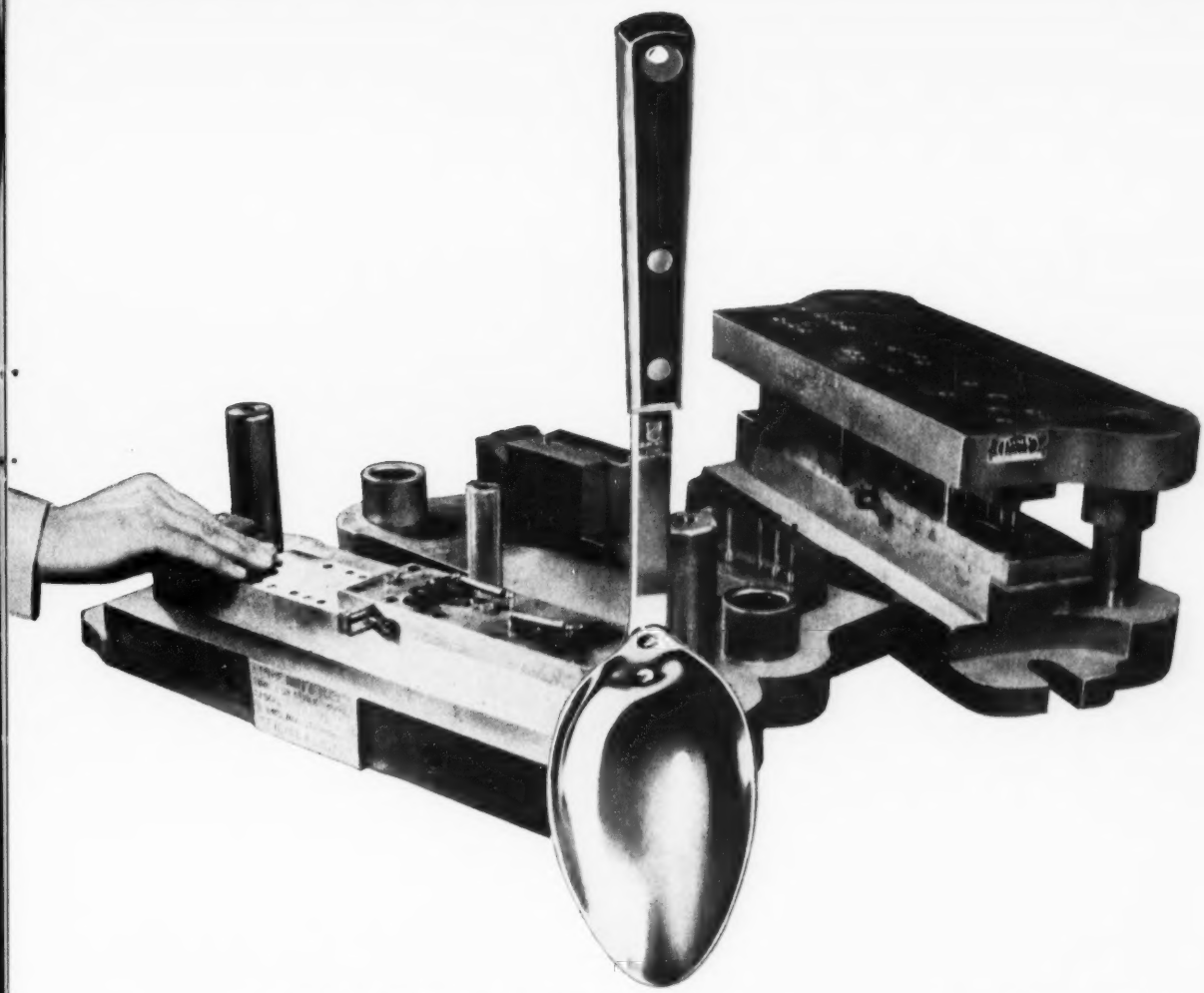
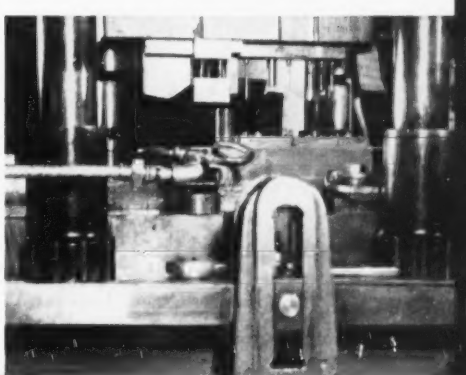


Ekco DEPENDS ON DANLY to save tooling time!

This popular basting spoon is one of thousands of famous household items made by Ekco Products Company in dies mounted in Danly Die Sets. Ekco depends on Danly Die Sets to save costly tooling time and help maintain uninterrupted production schedules in this highly competitive industry, because Danly Die Sets provide the finest *precision* starting point for diemaking. They are available on short notice from a completely stocked Danly assembly plant nearby.

It's a point worth remembering . . . when the job calls for *precision* performance, *depend on Danly Die Sets!* There's a Danly Branch near you . . . stocked for immediate delivery.



Call Your Local Danly Branch Today!

***CHICAGO** 50__2100 S. Laramie Ave.
***CLEVELAND** 14____1550 East 33rd St.
***DAYTON** 7_____3196 Delphos Ave.
***DETROIT** 16_____1549 Temple Ave.
***GRAND RAPIDS** ___113 Michigan St., N.W.
INDIANAPOLIS 4_____5 West 10th St.
***LONG ISLAND CITY** _____47-28 37th St.
***LOS ANGELES** 54____Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2___111 E. Wisconsin Ave.
***PHILADELPHIA** 40___511 W. Courtland St.
***ROCHESTER** 6_____33 Rutter St.

**Indicates complete stock*

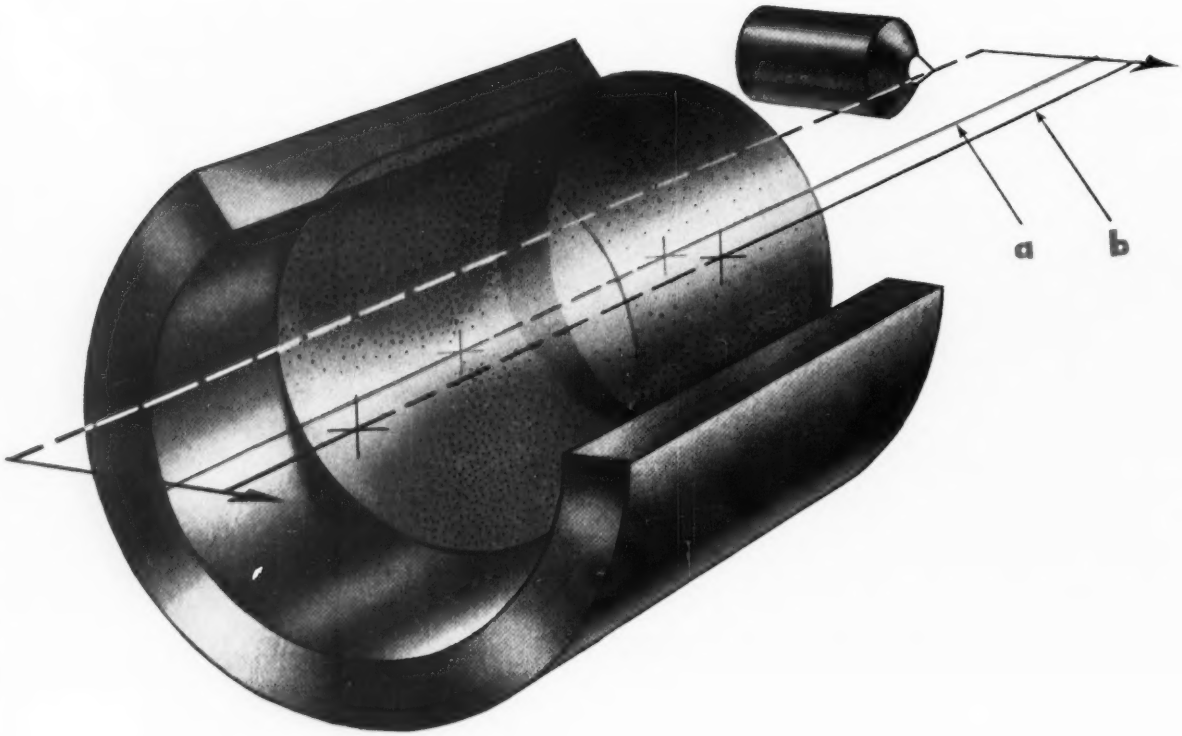
DANLY

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS SUPPLIES

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois

alignment

for better internal grinding

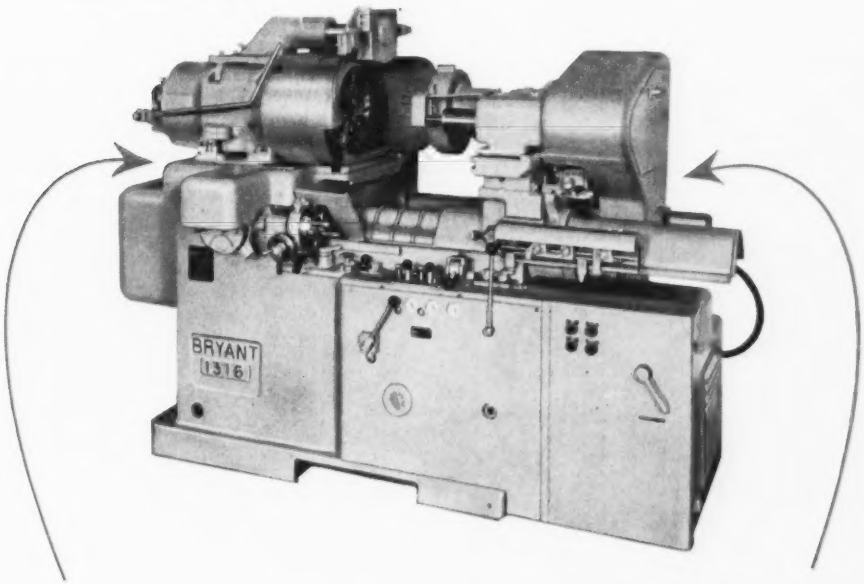


THE heart of the internal grinding process is the line of contact between the wheel and the work. This contact line must be straight for the full length of the wheel and the full length of work as the wheel traverses. If the contact is not a straight line, the internal grinder is "out of line". Improper alignment may show up in the work as incorrect hole geometry (bell-mouth or taper) and poor surface finish. In addition, excessive wheel wear and poor wheel action may result.

Several elements contribute to the straightness of this line of contact: first, the path along which the wheel is traversed "a" must be a straight line; second, the axis of the wheel must lie in a plane parallel to the wheel path "a", and third, the axis of the work "b" must be parallel to the wheel

path "a". For production grinding, the diamond must lie in the plane established by the wheel axis and the work axis.

Perfect alignment means that the slides must be straight and true, the wheel and work spindles must be in line and "zeroed" for center heights and the diamond must be on "dead center" of the wheel. A full, straight line of contact will extend wheel life, improve wheel action, and will assure correct geometry and required finish.



Left end of workhead may be raised or lowered to bring its axis into a plane parallel with the wheel path.

Rear of wheelslide may be adjusted to insure straight line motion of the wheel.

The Bryant 1316 hydraulic internal grinder is specially adapted for parts on which two or more grinding operations are to be performed at one chucking. This machine is made in several types suitable for such jobs as grinding bore and face where squareness is critical, or inside and outside diameters where concentricity is important. Straight and tapered holes in parts up to 16" diameter can be ground to a depth of 8 or 9". The workhead may be swiveled for grinding tapers up to 90° included angle. Stable 3-point support is provided under the wheelslide. The workslide moves on four anti-friction bearings spaced to give maximum support. Write for folder.

Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie — free showings arranged for engineering groups.

Bryant Chucking Grinder Co.

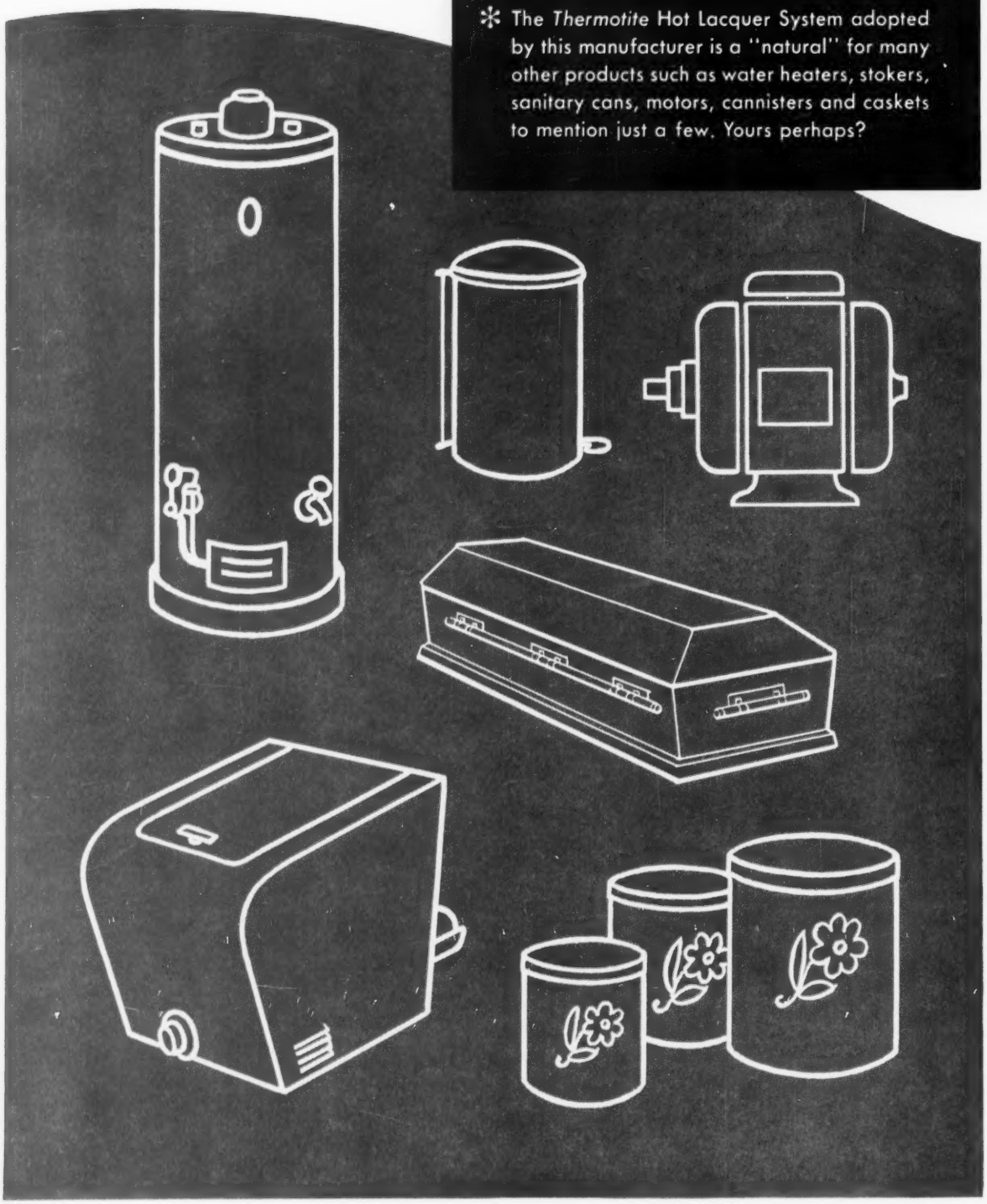
Springfield, Vermont, U. S. A.

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

Lowe Brothers *THERMOTITE*

Eliminates 2 handling operations

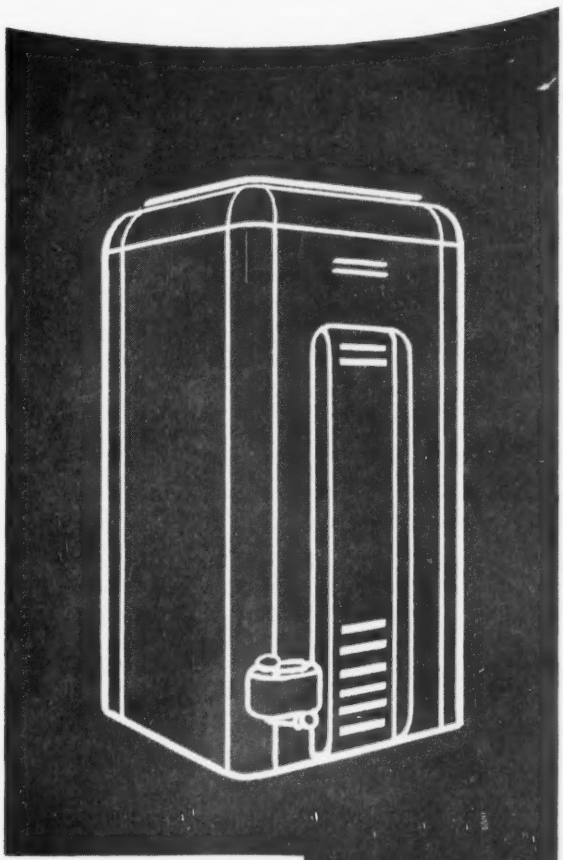
✻ The *Thermotite* Hot Lacquer System adopted by this manufacturer is a "natural" for many other products such as water heaters, stokers, sanitary cans, motors, cannisters and caskets to mention just a few. Yours perhaps?



solves production bottleneck

by cutting drying time 600%

This manufacturer of gas and oil furnaces* was using a finishing system which produced highly satisfactory results from every standpoint of gloss, adhesion, appearance and durability. It was necessary, however, to move finished parts from the line to a storage place for an hour's drying time before handling and packing—a costly production bottleneck. A Lowe Brothers "Finishing Specialist" recommended *Thermotite* as a means to eliminate this bottleneck yet retain all of the desirable characteristics of the finish used previously.



NOW, with *Thermotite*, parts are dry, ready for packing within 9 minutes! Packing is done just as pieces leave the production line. No extra handling, no moving, no special storage, no costly bottleneck—just big savings!

BUT MOST IMPORTANT, the "hot application" method recommended by Lowe Brothers "Finishing Specialist" produces a finish with every desirable characteristic of the former system—good build, excellent adhesion, one coat application and a tough, durable high gloss film, free of marring!

MANY manufacturers have found it most profitable to have a Lowe Brothers "Finishing Specialist" check their finishing operations for possible improvement based upon thorough knowledge of the latest in modern systems and materials. How about you? No obligation—write today!

THE LOWE BROTHERS COMPANY • Dayton 2, Ohio
Industrial Division

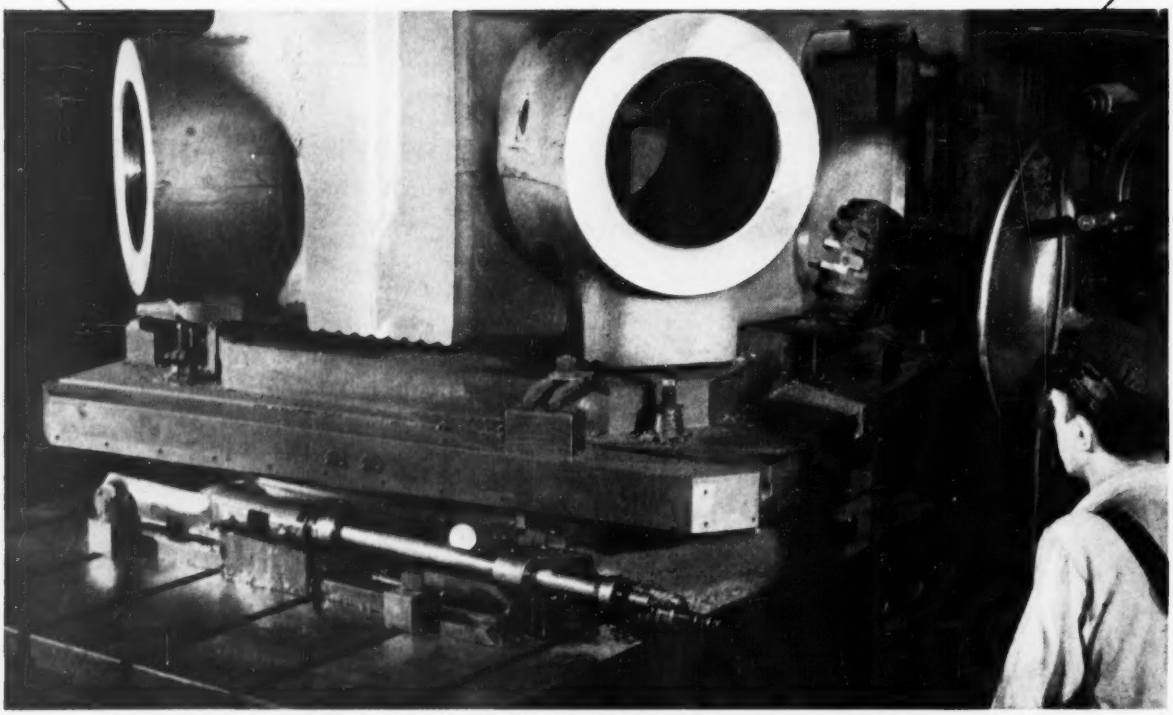
This advertisement is based on facts from Lowe Brothers industrial case history files.

LEADERSHIP THROUGH CONSISTENT SERVICE

Lowe Brothers
FINISHES FOR INDUSTRY

since 1870

How to beat multiple setups and cut unit costs too!



Giddings & Lewis Rotary Tables increase machine flexibility and working range on Horizontal Boring Mills

G&L Rotary Tables turn set-up time into profit time, perform many complex machining operations in a *fraction of the time* it takes on conventional tables. You can rotate and rapidly index work in horizontal, vertical or tilted positions without usual delays.

Illustration shows combination plain and hand feed Rotary Table that may be turned rapidly by hand to approximate position. Fine adjustments are made with hand crank. Other round or square sizes are available up to and including the 60″ x 96″ rectangular platens. Close-limit machining is made possible by table graduations to ½°, handy indexing stops, and dial indicator, accurate to .001″.

For all the information on G&L Rotary Tables for all types of horizontal boring, drilling and milling machines — write direct or contact your nearest G&L Distributor for bulletin A-20.

Available in Plain, Hand and Combination Power Feed Models

PLAIN — recommended for light work of two or more surfaces. Sizes: Round — 24″ to 48″; Square 30″ to 48″.

HAND — recommended for several surfaces. Round — 24″ to 30″.

COMBINATION, PLAIN, HAND AND POWER FEED — has 18 power feeds. Sizes: Round — 36″ to 60″; Square 36″ to 60″, Rectangular — 36″ x 48″ to 60″ x 96″.

GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

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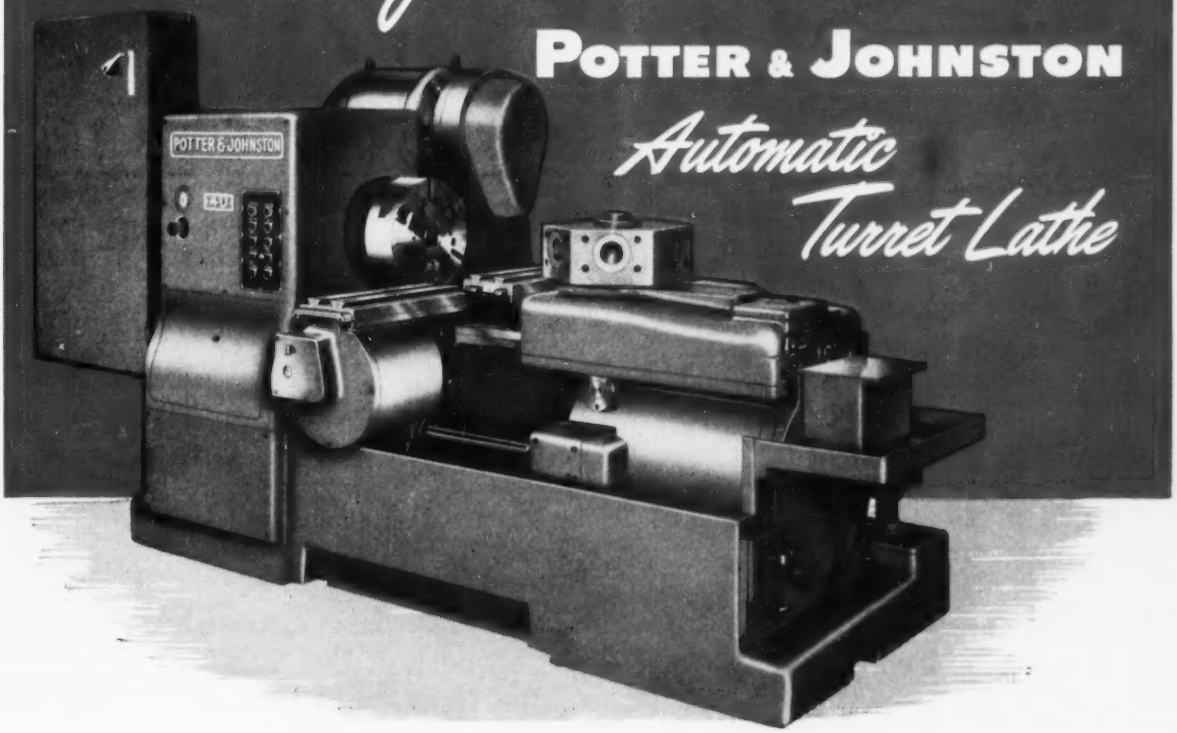
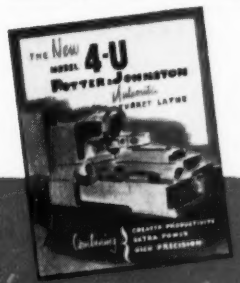
Introducing THE NEW MODEL 4-U

POTTER & JOHNSTON *Automatic Turret Lathe*



There's one way to beat today's rising production costs . . . turn out the work faster, more economically. And this new P&J Model 4-U is designed to do just that! It's a tough, rugged workhorse with that EXTRA power that's needed to take full advantage of modern carbide tooling for fast metal removal on the toughest alloys. Want proof? A recently installed 4-U consistently removed **4 pounds of 1118 SAE steel in just 30 seconds** . . . in regular, production line operation.

But speed and toughness aren't all; the 4-U is also extremely versatile and offers unusual opportunities for tooling that will help cut machining times to a money-saving minimum.



SEND NOW FOR COMPLETE INFORMATION

Write direct or contact your nearest Pratt & Whitney Branch Office. Ask for your copy of Bulletin No. 153.

Features

25 HORSEPOWER MOTOR . . . for fast metal removal on the toughest alloys.

CAPACITY . . . chuck sizes: 10"—12"—15"

EXTRA LARGE DOG DRUM . . . reduces set-up time

ALL-CLUTCH DRIVE . . . allows instant starting and stopping of spindle and changes of automatic speeds.

INDEPENDENT FRONT and REAR CROSS SLIDES . . . for added tooling versatility

HEAVY DUTY PRECISION SPINDLE . . . *is* accurate, *stays* accurate.

BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., PAWTUCKET, RHODE ISLAND

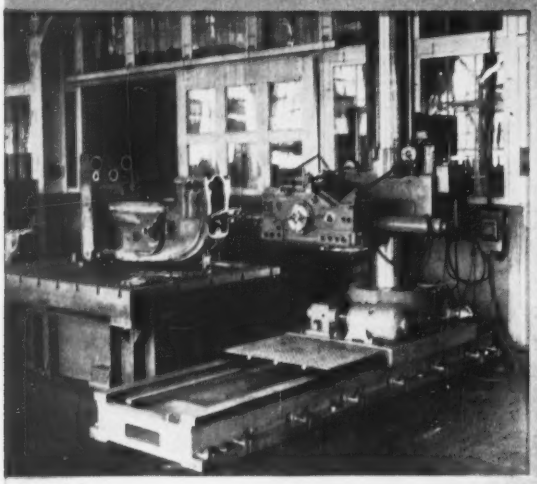
AGENTS: DALLAS, THE STANCO CO. HOUSTON, WESSENDORFF, NELMS & CO.

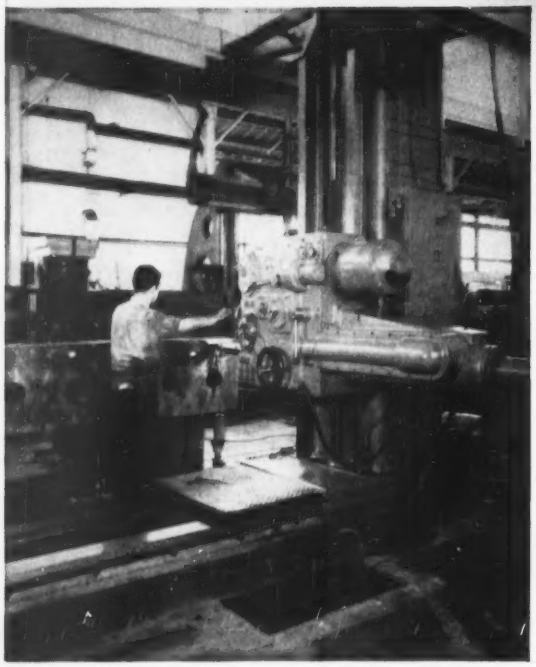
POTTER & JOHNSTON CO.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES – BEMENT – POND COMPANY

P&J

COMPETE PROFITABLY REPLACE WITH P&J

Horizontal Drilling Machines by Kaukauna AT WORK....





Performing quick, accurate drilling operations on press frame parts—drilling, fixture boring, tapping operations on milling machine columns—drilling all four parts of a tractor frame on a repetitive production line basis—these are the types of jobs illustrated, showing Kaukauna Horizontal Drilling Machines at work. The time and labor savings are of course apparent—elimination of expensive crane lifts, reduction in handling time, inexpensive tooling.

As illustrated, there is a Kaukauna Horizontal Drilling Machine in a size suitable for any class of work from small, high production jobs to extremely large work pieces. These extremely versatile machines make for greater work simplification and may be used to advantage in your shop for driving boring fixtures, drilling, reaming, boring, counterboring, tapping and spot-facing operations.

Kaukauna builds Universal Radial Drills and Horizontal Drilling Machines in a range of sizes which meet practically all requirements in modern production practice. Write today for descriptive catalog or ask representative to call.

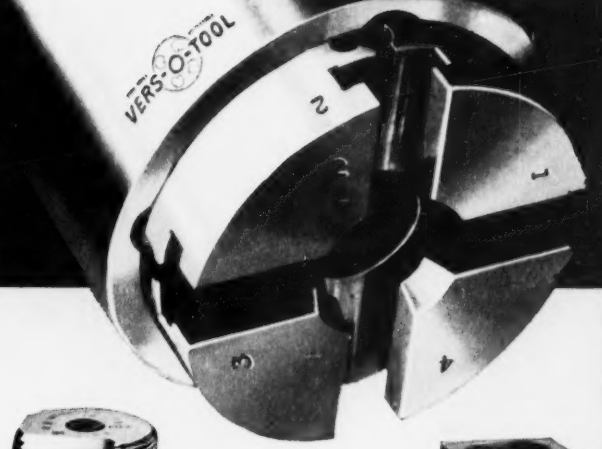
KMC Kaukauna MACHINE CORPORATION

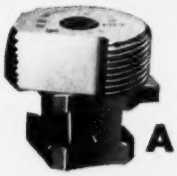
KAUKAUNA, WISCONSIN, U. S. A.

For more information on products advertised, use Inquiry Card, page 243

VERS-O-TOOL

CHOICE



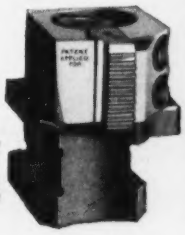


A

CIRCULAR GROUND THREAD CHASER
HEAD SIZES: 3/16 - 6½"

ADJUSTABLE BLADE CHASER
HEAD SIZES: 3/8 - 2"

B



It's this simple...you start with a precision built self-opening die head —the Vers-o-tool—then just choose either of two types of chasers least costly for the job.

A If it is a long run job—specify circular ground thread chasers. They give you maximum chaser life by any comparison, regrind to a full 270° circumference. Up to 10,000 threads per grind on screw stock isn't unusual.

B For smaller lot threading—use the Namco Adjustable Blade type chasers, also with ground threads.

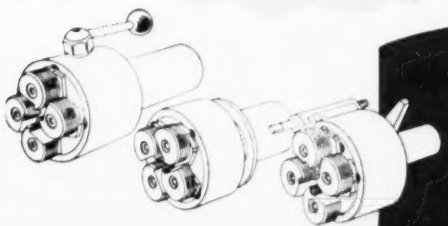
Both styles are interchangeable, head size for head size, between revolving and non-revolving Vers-o-tools.

ONE VERS-O-TOOL and SELECTIVE CHASERS . . .

cuts your threads . . .
cuts your tool investment
and cuts your operating costs

This system also includes a Namco Micrometer Gage, which checks the chasers—does away with trial cuts after grinds, gives many more pieces per grind, reduces reject losses and saves wasting expensive man-hours. Class 3 threads are guaranteed—and smoother.

Every month, more threading departments join our lists of exclusive Vers-o-tool users. Maybe you'd like to try out this double-duty head. If rising costs are your problem—you should. Send a sample with "specs," large or small run, and we will show you. Ask for Catalog DT-52.

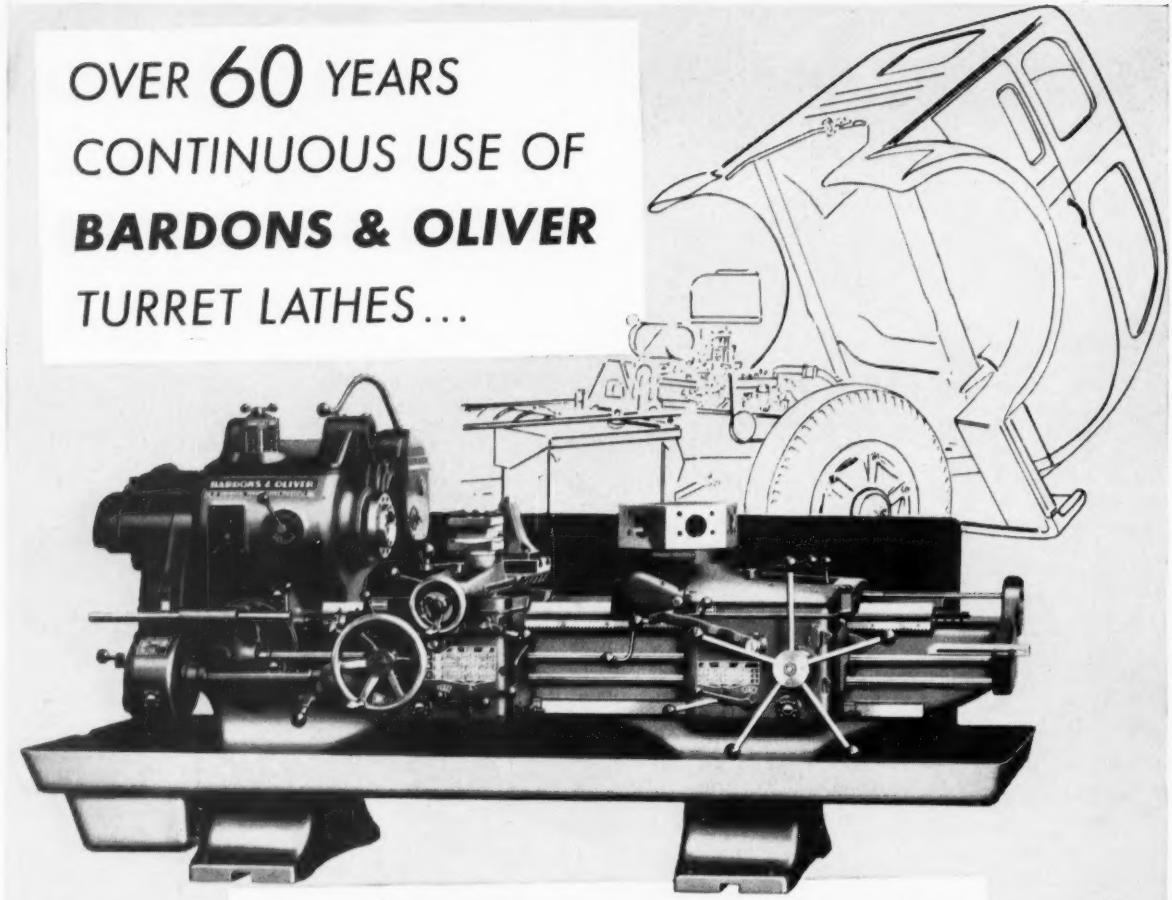


The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.

OVER 60 YEARS
CONTINUOUS USE OF
BARDONS & OLIVER
TURRET LATHES...



at *White* MOTOR CO.

Good machine tools are essential to production of quality automotive products. For over 60 years White Motor Co. has been a continuous user of Bardons & Oliver Turret Lathes in the production of their famous trucks—so well known for their ruggedness and long life. Last year White Motor ordered an additional five Bardons & Oliver Turret Lathes.

These repeat orders are the best evidence of the quality, performance and cost reduction that the users of Bardons & Oliver Turret Lathes enjoy.

Let us show you how Bardons & Oliver Turret Lathes can contribute to the quality and cost reduction of your product. Available in seven sizes . . . all outstanding for maximum production.

MANUFACTURERS OF A COMPLETE LINE OF TURRET LATHES AND CUTTING OFF LATHES

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

For more information on products advertised, use Inquiry Card, page 243

convert your portable tools into fast, efficient BELT GRINDERS

On every straight-spindle tool in your shop, you can "bring the abrasive belt to the work" with sturdy "61" PORT-A-BELT Grinding Attachments by CARBORUNDUM. You get versatility and economy unmatched by any other portable tool—fast, low cost grinding on *any* surface... even the awkward, hard-to-reach areas!

The four PORT-A-BELT attachments easily do contact wheel grinding on flat, convex or concave surfaces—and slack-of-belt grinding on flat, irregular or convex. One operation with PORT-A-BELT often replaces two or three with conventional finishing tools. Saves time, money.

Every PORT-A-BELT unit is equipped with CARBORUNDUM's famous "61" Contact Wheel, with its serrated rubber face. When used with CARBORUNDUM® Brand Abrasive Belts, these contact wheels give you smooth, cool, rapid cutting . . . without bounce or chatter. Belts last up to twice as long because they don't load up as fast.

PORT-A-BELT Grinding Attachments are precision-made, sturdy enough to take more than normal shop abuse. There's nothing to get out of adjustment!

YOUR CARBORUNDUM DISTRIBUTOR OR SALESMAN will show you how to convert your straight-spindle grinders into fast, efficient belt grinders. He's listed in the yellow pages under "Abrasives." Or, if you prefer, send the coupon.

THE CARBORUNDUM COMPANY
Dept. M 82-41, Niagara Falls, N. Y.

Yes! Send folder and prices on PORT-A-BELT Grinding Attachments to:

NAME

COMPANY

STREET AND NO.

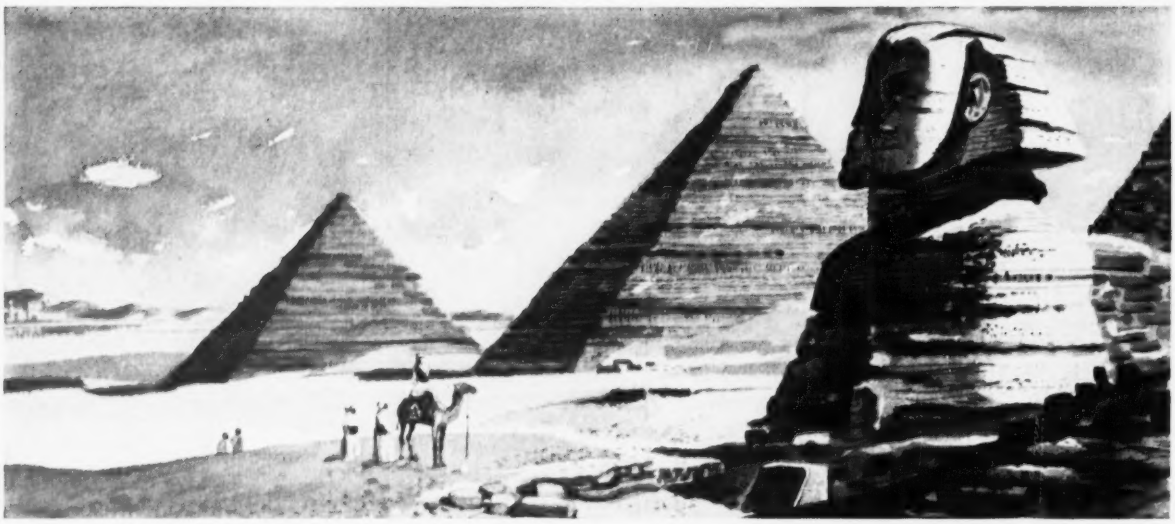
CITY ZONE STATE

CARBORUNDUM

REGISTERED TRADE MARK

...continually putting more sense in your abrasive dollar!

82-41



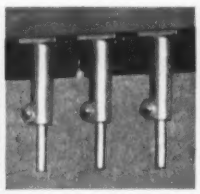
DURABILITY

...you get it with a Minster Press

■ When you see Minster on the nameplate you are looking at a press with an unusual reputation for long time trouble free operation. Here is machine tool durability at its best . . . here is the extra stamina so necessary today in modern power press operation.

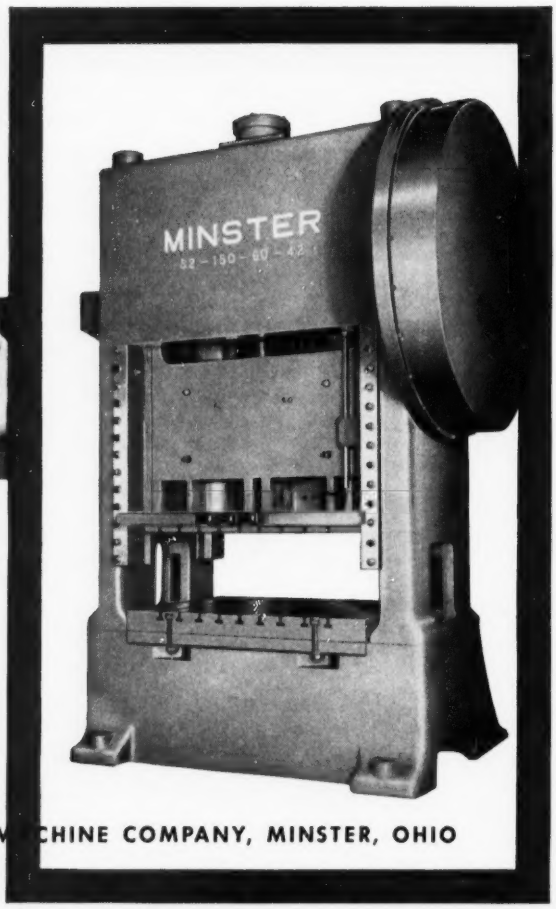
Do you have a replacement program for old, obsolete equipment in your shop? Are you undertaking an expansion? If presses are involved, consider the added values you get with Minster presses . . . values good not only today but for many productive years to come.

Minster's remarkable air operated combination friction clutch and brake. 10, 12, 15 years of service with no repairs is commonplace.



Safer, faster adjusting knockout bars, a typical example of Minster's attention to details. Slip without damage if clearance is improperly set.

Minster presses are a long time investment, being built with extreme care, Precision machining of gibbing assures accurate slide alignment.



MINSTER
FIRST IN PRESS DESIGN

THE MINSTER MACHINE COMPANY, MINSTER, OHIO

For more information on products advertised, use Inquiry Card, page 243

Rivett 918 "Steelway" Turret Lathe

Now you can produce small duplicate parts speedily in unlimited quantities with precision known only to the toolroom!

For here's a lathe that's been developed out of the bench class into a production machine. It has all the inherent precision for which Rivett has long been famous, plus time-saving features that reduce set-up and cutting operations to a fraction of that normally required. Single part production can be powered and cycled automatically.

Any one of 120 to 3750 RPM cutting speeds may be instantly and accurately selected; newly designed collets increase speed of operation as well as accuracy and gripping power; automatic chuck closer and well grouped controls step up operator time.

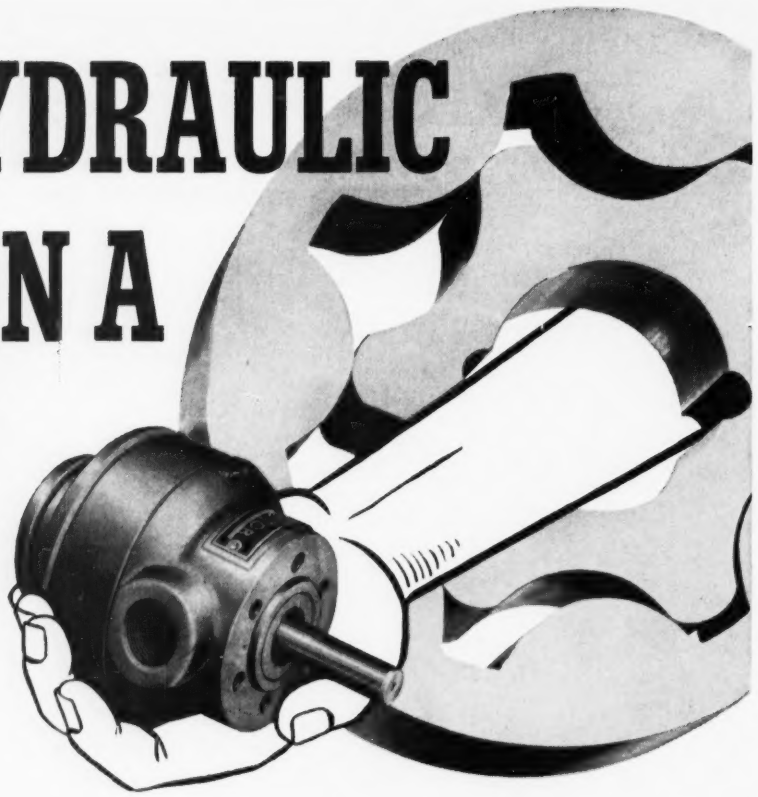
Bulletin 918ST will give you all the details. Write for your copy today.

RIVETT | **LATHE & GRINDER, Inc.**

Dept. MR-2 Brighton 35, Boston, Massachusetts

For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools

NEED HYDRAULIC PUMPS IN A HURRY?



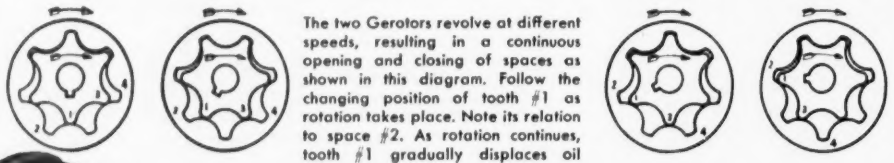
Now...

you can get hydraulic pumps WHEN YOU NEED THEM!

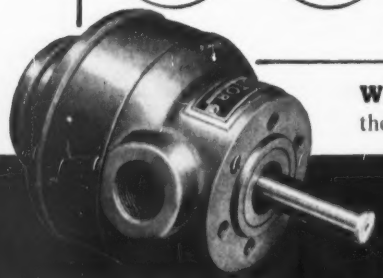
Gerotor can deliver from stock . . . immediately . . . any of their standard hydraulic pumps, covering ranges as shown in the table. If you have pump requirements and need immediate service . . . call, wire or write Gerotor today.

Type Pump	G.P.M. Range	P.S.I. Range	R.P.M.
"B"	4–1.5	0–1000	1800
"QDH"	3–12	0–1200	1200
"O"	20–40	0–1000	1200

Gerotor is not just a name . . . it's the principle of the thing



The two Gerotors revolve at different speeds, resulting in a continuous opening and closing of spaces as shown in this diagram. Follow the changing position of tooth #1 as rotation takes place. Note its relation to space #2. As rotation continues, tooth #1 gradually displaces oil from space #2, thus creating pressure.



Whatever your need in hydraulic pumps or motors, consult the Gerotor May engineers. *Write for free literature.*

GEROTOR MAY CORP.
BOX 86
BALTIMORE 3, MD.

GEROTOR
HYDRAULIC PUMPS & MOTORS

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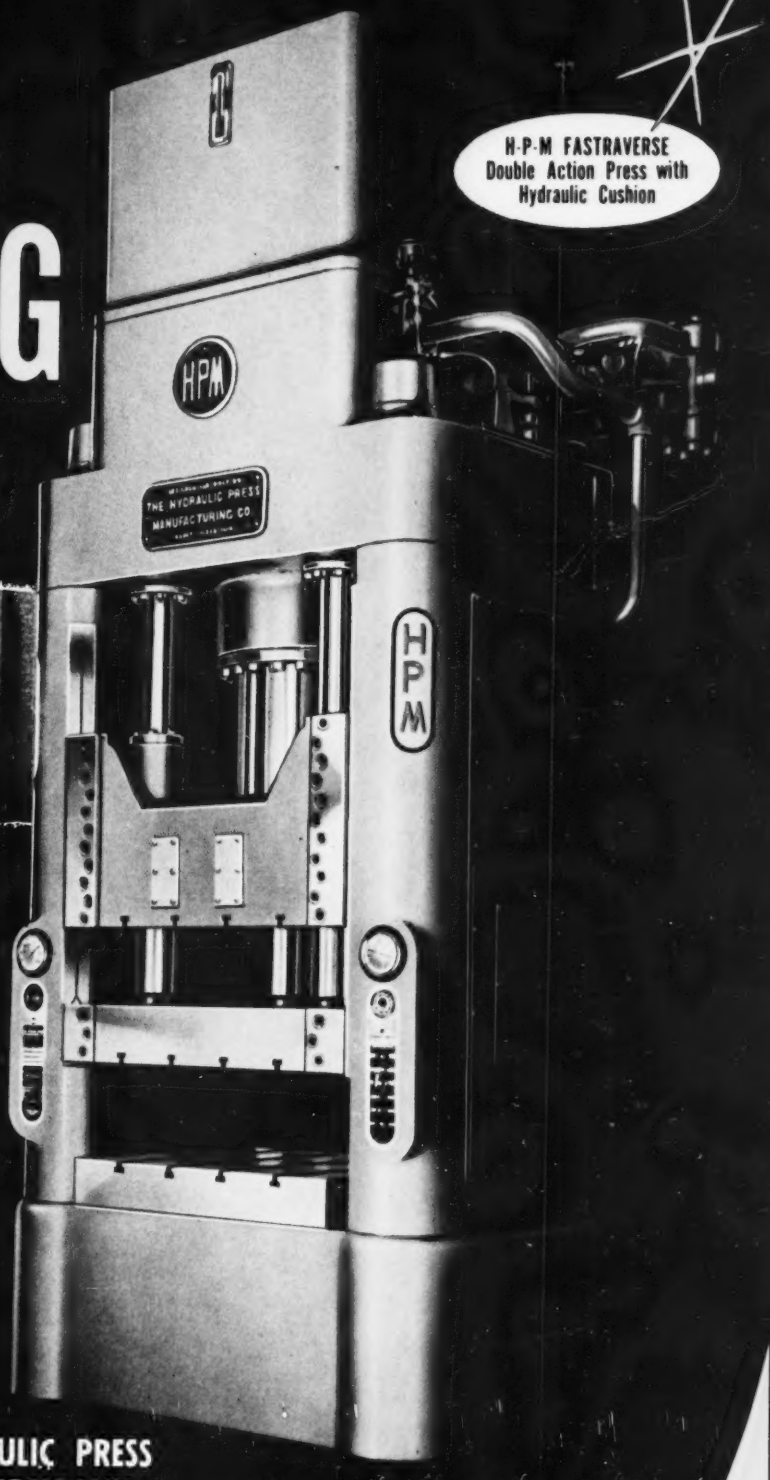
METAL WORKING

Calls for H-P-Ms



Drawing, forming, coining, embossing, flanging, sizing, trimming, die straightening . . . H-P-M all-hydraulic FASTRAVERSE presses are the sure way to increase production profits on all metal working operations. Here is actually 4 presses in 1 . . . single action, single action with cushion, double action, double action with cushion . . . for universal application. Talk to an H-P-M engineer today.

HPM

THE HYDRAULIC PRESS MFG. COMPANY

MOUNT GILEAD, OHIO, U.S.A.

A FEW OF THE HUNDREDS OF USERS OF H-P-M ALL-HYDRAULIC FASTRAVERSE PRESSES

Admiral • Allis-Chalmers • American Locomotive
Boeing • Briggs • Budd Wheel • Buick • Douglas
Caterpillar Tractor • Chevrolet • Chrysler • Goodrich
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Ford • General Electric • Westinghouse • Goodyear
General Motors • Hot Point • Hughes Tool • Modine
International Harvester • J. I. Case • Western Electric
John Deere • Lockheed • Massey-Harris • Mullins
North American • Oldsmobile • Oliver • U. S. Steel
Pratt & Whitney • Revere Copper & Brass • Servel
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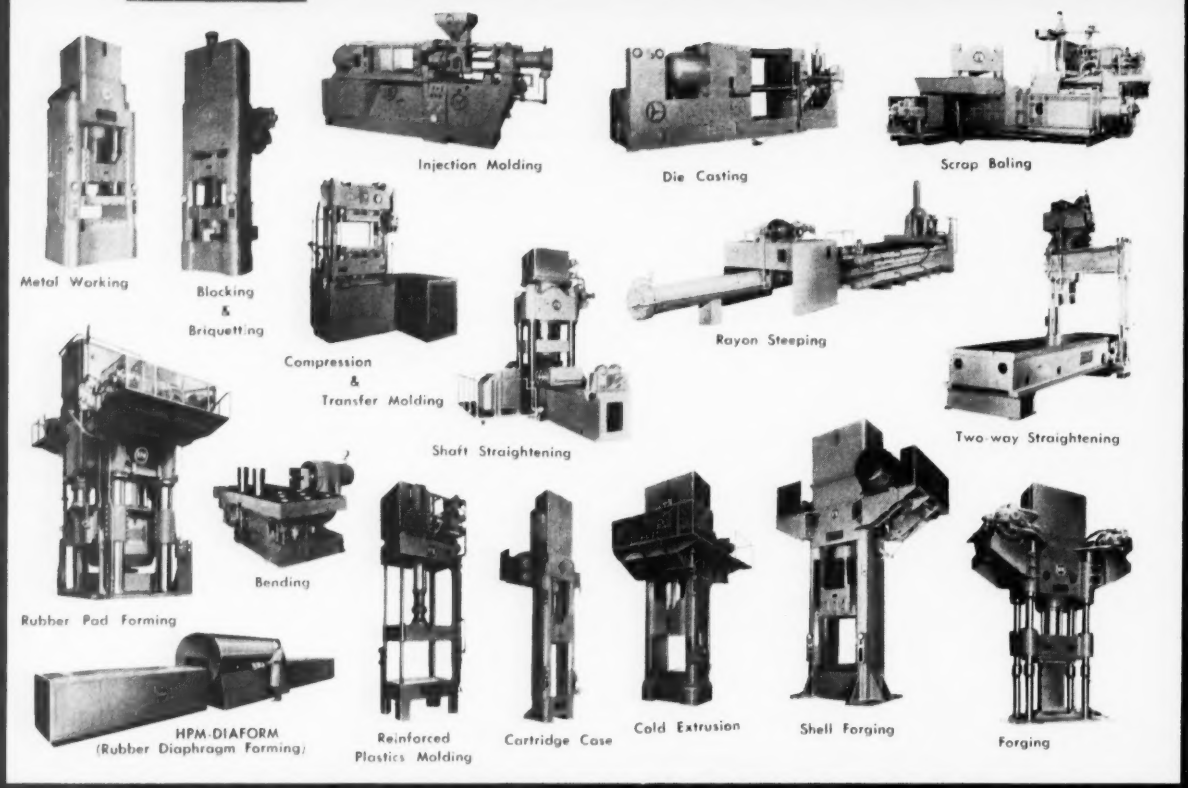
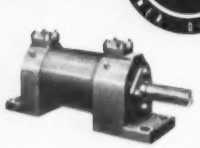
SEE H-P-M's COMPLETE LINE

ALL-HYDRAULIC *FASTRAVERSE* PRESSES FOR EVERY PRESSURE PROCESSING NEED!



A *NEW* COMPLETE LINE OF HYDRAULIC COMPONENTS!



CYLINDERS
150 P.S.I. Air and 300 to 3000 P.S.I. Oil Hydraulic

VALVES
Directional and Functional, complete range to 3000 P.S.I.

PUMPS & MOTORS
Fixed and Variable Displacement to 3000 P.S.I.

POWER UNITS
Complete power packages for every application.

ACCESSORIES
Items to complete that hydraulic circuit.

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DETROIT 2, MICHIGAN
MOUNT GILEAD, OHIO
TEANECK, N. J.
PITTSBURGH 22, PA.

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BIRMINGHAM 3, ALABAMA
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CAMBRIDGE 42, MASS.
Austin Hastings Co., Inc.
DALLAS, TEXAS
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DENVER, COLORADO
The Mine & Smelter Supply Co.
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The H. L. Thompson Co.
KANSAS CITY, MISSOURI
Blackman & Nuetzel Mach. Co.
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Machinery Sales Co.
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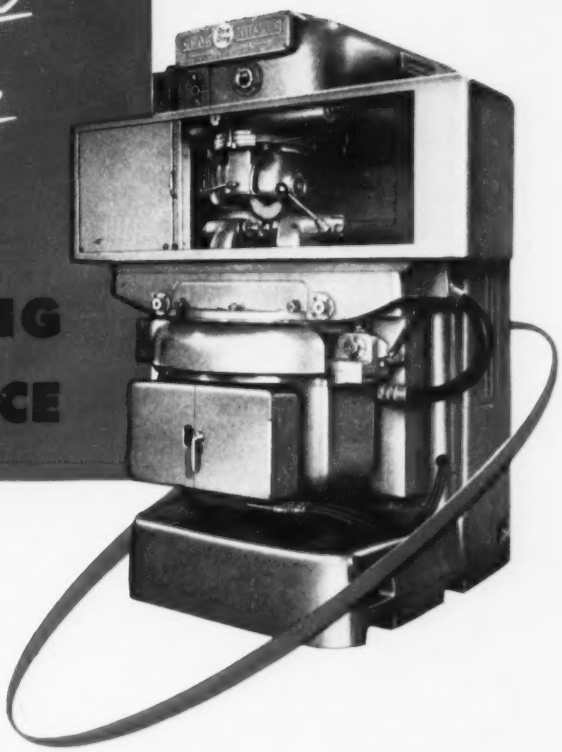
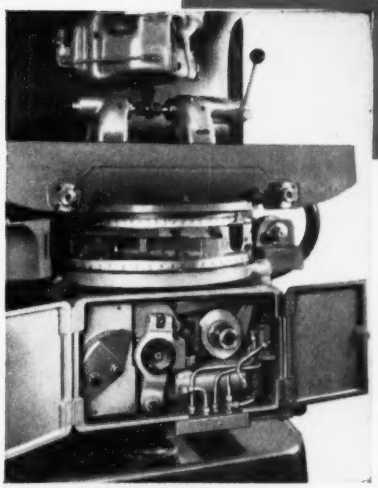
EXPORT DEPARTMENT
MOUNT GILEAD, OHIO
The Hydraulic Press Mfg. Co.
CABLE ADDRESS: "HYDRAULIC"

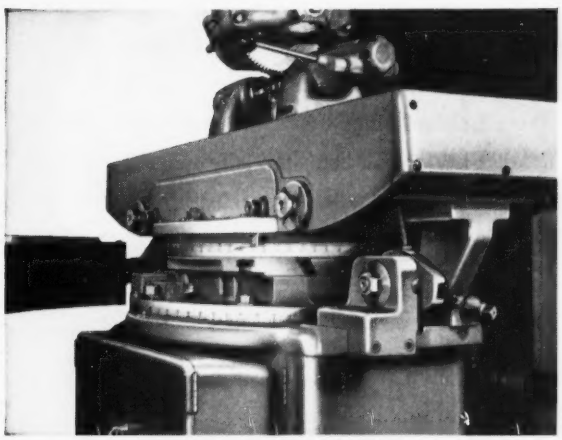
THE HYDRAULIC PRESS MFG. CO. / MOUNT GILEAD, OHIO, U. S. A.

An Important Contribution To GEAR SHAVING PRACTICE





Differential up-feed mechanism



Crowning cam and bracket

Two new features are now optionally available with the Red Ring Gear Shaving Machine Model GCU — Automatic Differential Up-feed and Conventional Crowning. So equipped, any of the recognized processes in the field of rotary gear shaving may be performed on this machine. It thus becomes economically applicable to both high production and to job shop operations and to gears of all characteristics within its size range.

Specifically the Model GCU with these additions can be used for:

(1) Diagonal shaving at fixed center distance on a two stroke cycle.
(2) Diagonal shaving on an automatic multi-stroke cycle with selected increments of up-feed and dwell.
(3) Conventional shaving on an automatic multi-stroke cycle with selected increments of up-feed and dwell.
(4) Precision gear crowning accomplished by rocking the table during any conventional shaving cycle.
(5) Taper shaving to specification.

Automatic cycling is precise and very fast. Production rates are high and cutter life has been increased to as much as 200%.

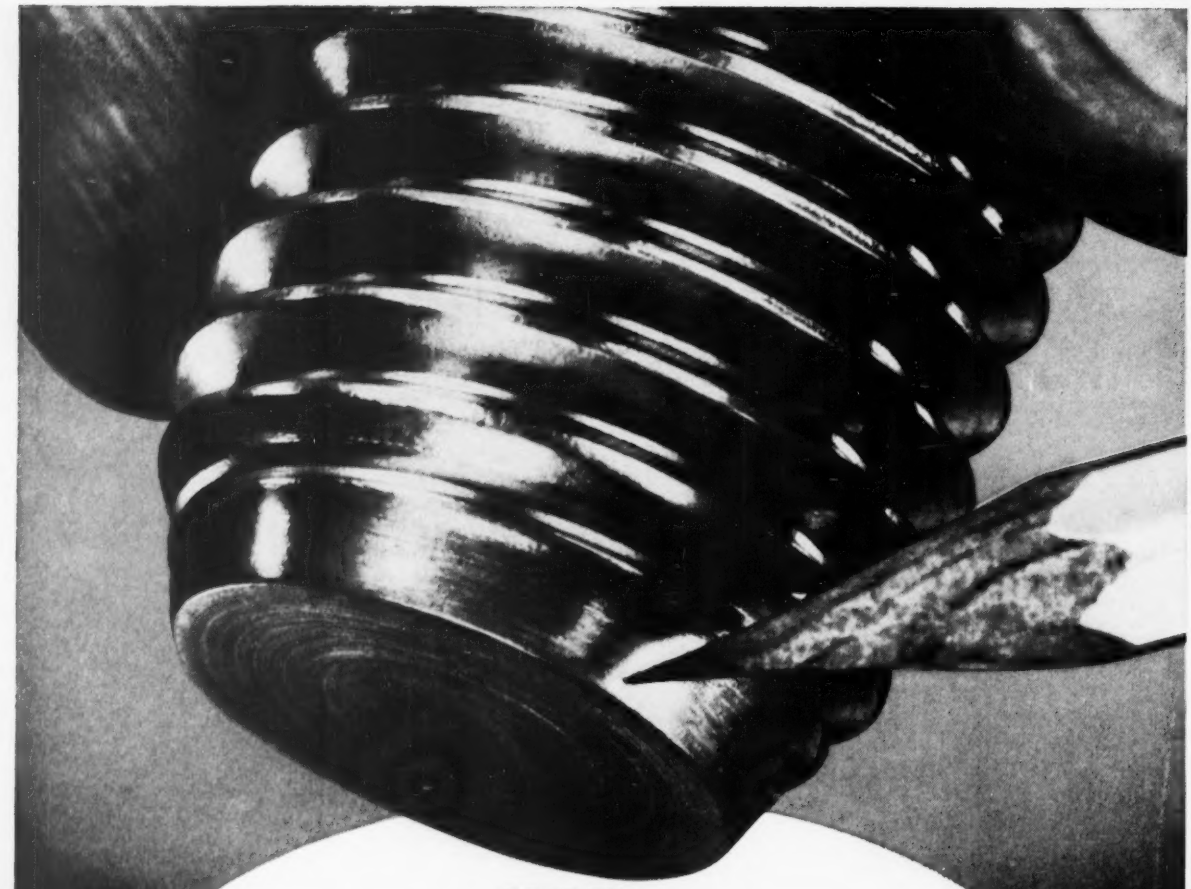
Write for Bulletin S53-7 which gives all the details of this important new development.

6501

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

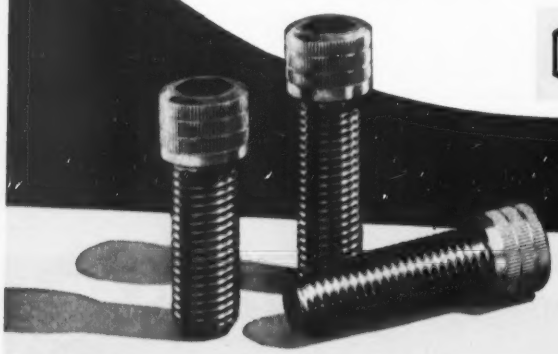
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



NEW

Allen leader point cap screws

Dropping, knocking against metal surfaces and faulty line-up are major causes of damaged threads. Allen's new unthreaded leader point substantially reduces the causes of screw thread injury, or damage to threaded holes. Grip Heads, precision fit sockets that adhere to the key, *plus* the new leader points, make Allens the world's easiest starting cap screws, particularly in inaccessible spots. Sold *only* thru leading Industrial Distributors.



ALLEN HEAD

ALLEN

MANUFACTURING COMPANY

Hartford 2, Connecticut U.S.A.

For more information on products advertised, use Inquiry Card, page 243

TOOL LIFE UP 75%

DOWN-TIME DOWN 43%

PRODUCTION UP 45%

USING SHEAR-SPEED SOLUBLE OIL

on multiple "single-point" form cutting operation in the plant of a large auto manufacturer. IMPARTIAL PRODUCTION TESTS of previous "best" cutting fluid vs. SHEAR-SPEED Soluble Oil were run under *exactly* similar conditions—same machine, same parts, same tool grinding, same coolant flow.

JOB SPECS: 24-tooth transmission gears, 2.5" pitch dia., 1.185" face width, cut two at a time on gear shaper from SAE bar steel, 207-228 BHN.

ACTUAL TEST DATA (averaged)

■ Previous Best Cutting Fluid

■ SHEAR-SPEED Soluble Oil

	Previous Best Cutting Fluid	SHEAR-SPEED Soluble Oil	
OVERALL TOOL LIFE	15,200 parts	26,600 parts	75% improvement
DOWN-TIME PER PART	.0625 min.	.0357 min.	43% improvement
PARTS PER HR. (INC. DOWN-TIME, ETC.)	86	125	45% improvement
CYCLE TIME* (FLOOR-TO-FLOOR)	55 sec.	35 sec.	36% improvement

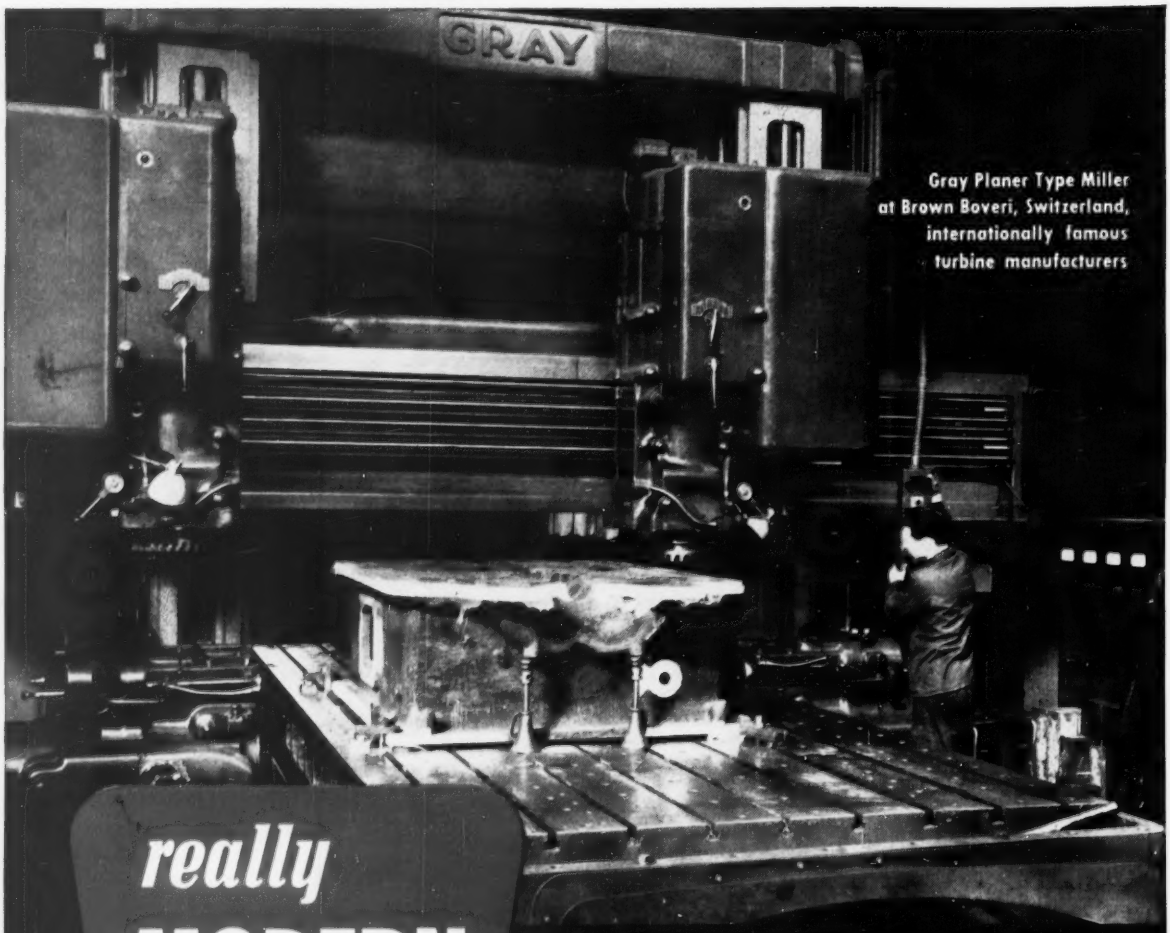
*Tool life increased despite higher cutting speed.

A few select sales areas still available.

Convince yourself of the amazing advantages and versatility of SHEAR-SPEED Soluble Oil in your own plant. Sold only on a satisfaction guaranteed test basis. Write for Bulletin SO-53 and price list.

SHEAR-SPEED CHEMICAL PRODUCTS

7125 E. McNICHOLS RD. *A Division of Michigan Tool Co.* DETROIT 12, MICH.



Gray Planer Type Miller at Brown Boveri, Switzerland, internationally famous turbine manufacturers

really MODERN MILLING

with finger tip control

● GRAY PLANER TYPE MILLERS with their modern unit head design are setting production records in shops all over the world. The Unit Heads with individual spindle motors make possible a wide variety of simultaneous high horsepower cuts. (Swivel or non-swivel heads are available as desired). The Low Hung Drive to spindle thru a balanced planetary gear train with fly wheel inertia provides the ideal high horsepower carbide cutter drive. Speeds up to 1000 RPM instantly obtainable by the flick of a lever. Terrific power to answer any demand is always at your finger tip. Its performance will prove to you that . . .

Quality doesn't cost — IT PAYS.

The G.A. GRAY *Company*

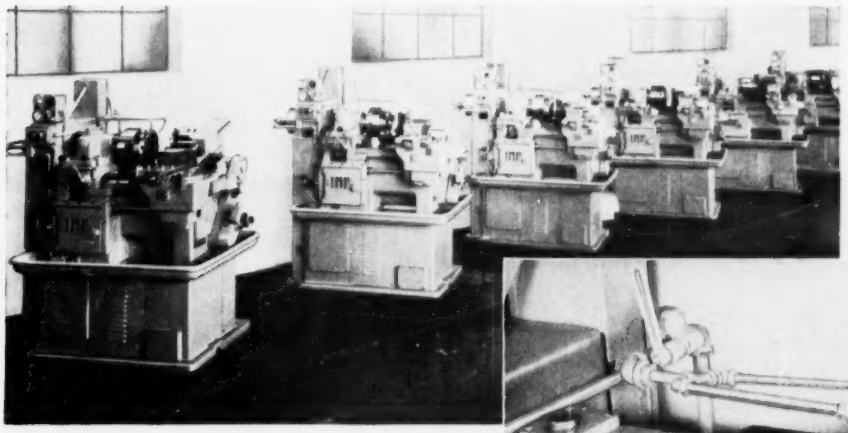
planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

For more information on products advertised, use Inquiry Card, page 243

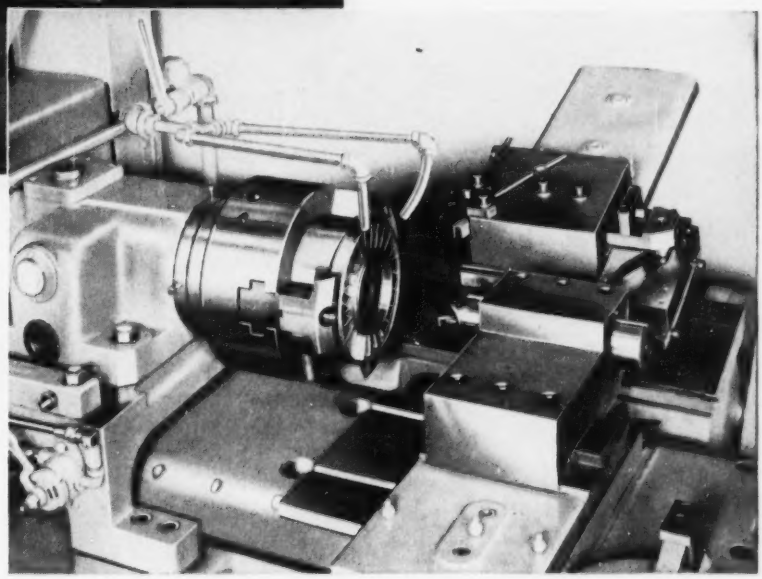
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



Left: Several of a group of Lo-swing IMP's used in machining Automatic Transmission Parts.

Below: Close-up view of tooling.



AUTOMATIC TRANSMISSION PARTS MACHINED AUTOMATICALLY ON Lo-swing IMP

Problem: **To bore and face welded Torque Converter Stator Assemblies. Parts must be held without distortion and machined within close limits.**

Solution: **IMP Automatic Lo-swing Lathes were selected for this work due to ease of operation, high spindle speeds, compactness and rigidity. The upper illustration shows several of a group of machines installed for this class of work. The lower illustration shows one of the lathes, with coolant guard removed, equipped for boring and facing one of the Torque Converter Stator Assemblies. The part is held in a three-jaw, air-operated chuck fitted with wide mushroom type jaws to prevent distortion of the piece. The boring operation is made with two carbide tipped tools mounted in a boring bar and holder and fitted to the front slide. Tool relief is provided on the return stroke. The facing and trimming tools are mounted on a template controlled rear tool block which permits the facing operation to be made at the correct angle. The operation is entirely automatic, the operator simply loads and unloads the parts.**

Engineered jobs are our specialty. Our staff is at your disposal to help solve your problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

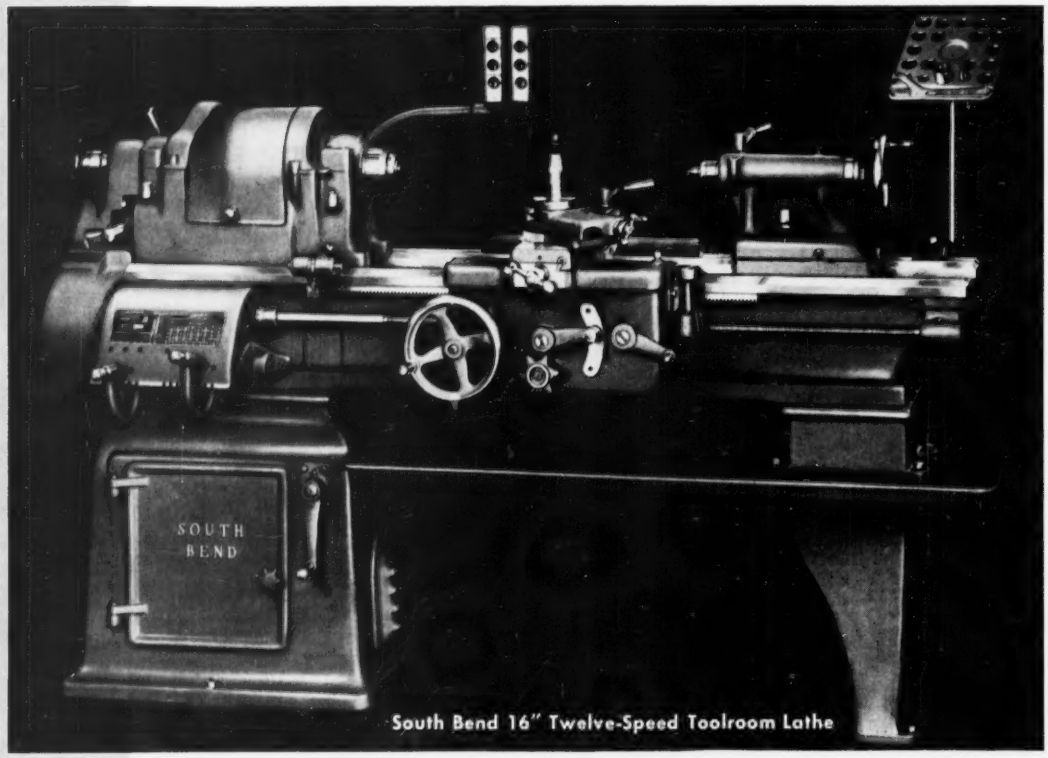
Cuts Machining Time

The wide range of spindle speeds on this new lathe cuts machining time because the operator quickly selects the right speed for each operation. Pushbutton control provides a fast change from any high speed to the corresponding low speed. This versatility is further increased by 48 choices of longitudinal and cross feeds which insure maximum efficiency on every job. Also, you will

SOUTH BEND 12 SPEED LATHE

find that its accuracy and ease of operation makes your tough job easy. Send the coupon for complete information.

CL8155C, 6′ bed, below, f.o.b. factory **$2690.00** less electrical equipment. Time terms available: 10% down, the balance in 12 or 18 months.



South Bend 16" Twelve-Speed Toolroom Lathe

SPECIFICATIONS

Spindle Speeds — 12. Direct drive: high range 300, 550, 945; low range 150, 278, 475. Back gear drive: high range 32, 70, 118; low range 20, 33, 60.

Spindle Bore — 1⅜".

Swing over bed and saddle wings — 16¼".

Swing over saddle cross slide — 9⅝".

Distance between centers — 33¼", 45¼", 57¼", 81¼", 105¼".

Collet Capacity — 1" maximum.

Longitudinal Feeds — 48 R.H. or L.H., .0015" to .0841".

Cross Feeds — 48, .0006" to .0315".

Thread Pitches — 48, 4 to 224 per inch.

Can I get it? When? How?

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

South Bend machine tools with accessories may be purchased on convenient terms up to 12 months.

PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES

☐ ½" & 1" Collet TURRET LATHES

☐ TOOL GRINDERS

☐ 7" BENCH SHAPERS

Name _____ Company _____

Street _____ City & State _____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

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Don't risk DIE BREAKAGE!

Specify PRODUCTO ACCESSORIES

High-Pressure Springs made of Chrome-Vanadium Steel

Dowel Pins Accurately Ground for Precision Dies

If an inferior spring breaks . . . it might mean trouble during the stamping operations and could possibly cause a several thousand dollar die to be damaged. More than that, losses pile up as press down-time and maintenance costs climb.

Protect the big investment, the die itself . . . *buy only quality die accessories.* Call your nearest Producto representative or branch for prompt service. Directory listings are found in all principal stamping centers.

Check List of Producto Die Makers' Accessories

High-Pressure Springs	Die Rubber
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THE PRODUCTO MACHINE COMPANY
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For Die Accessories *Fast*, Call . . . PRODUCTO

MAKERS OF DIE SETS, PRESS FEEDS, VISES, TOOL ROOM EQUIPMENT

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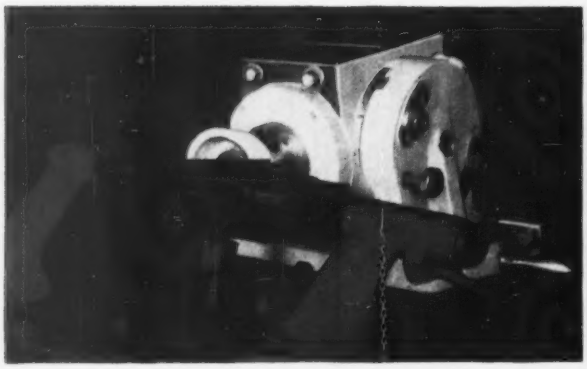
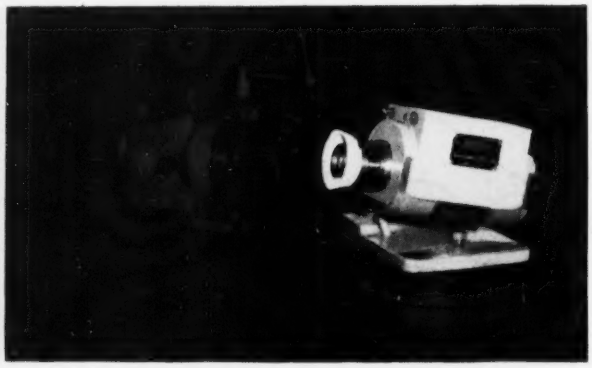
Specify THIS NEW POPE SUPER PRECISION 1 HP, 3600 RPM MOTORIZED TOOL AND CUTTER GRINDER CLEARANCE ANGLE SWIVELLING HEAD

With Angular Adjustment In A Vertical Plane





TIME AND MONEY SAVING FEATURES:

1. Cup wheels, generally considered best for cutter grinding, can be used for practically all clearance angles on this new head.
2. Cup wheels produce a cutting edge on tools that lasts longer because it is stronger.
3. The tooth rest remains on the center line of the cutter for practically all grinding on centers or in the work head.
4. Most cutters and reamers can be ground all over with one set-up, using the swivelling table and Pope tilting head. The usual second and third set-ups are no longer required.
5. All clearance angles read directly in degrees from the scale provided on the head. Mistakes on clearance angles are avoided.
6. The right clearance angle is assured on tools difficult to grind, such as slab mills, taper reamers, angular cutters and form tools.
7. 3600 R.P.M. — one wheel speed — safe for all wheels generally used on cutter grinders. Heat checking of cutters is virtually eliminated.
8. The operating ease and convenience of this new Pope Head with the angular adjustment in the vertical plane saves you time and money on every tool you grind.

ASK FOR COMPLETE SPECIFICATIONS

No. 96

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

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Saves Time... Cuts Costs

Rotary Planer • • • do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.

Big Sawing • • • production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.

The **ESPEN-LUCAS** *Machine Works*

Front Street and Girard Ave., Phila. 23, Pa.

BUILDERS OF LARGE COLD SAWING MACHINES • ROTARY PLANERS • COLUMN FACERS • HEAVY TYPES OF SPECIAL MACHINERY

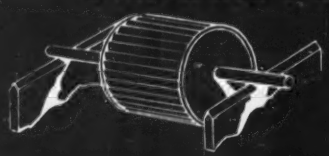
How times have changed!

for instance:

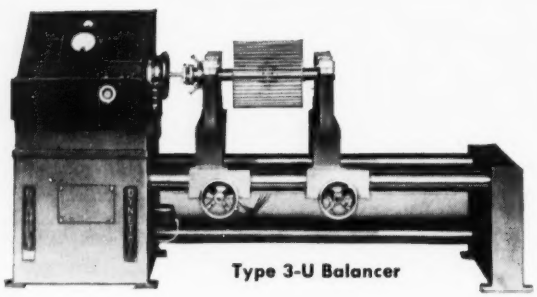
This was transportation . . . . **NOW** this is it.

This was the best cleaner . . . . until we got **THIS.**

The old rub-a-dub washdays . . . . gave way to **THIS.**



This was a balancer . . . . . . until we built **THIS!**



Type 3-U Balancer

Any job worth doing is worth doing *right!* And with today's precision manufacture and high-speed rotating parts, that applies to balancing more emphatically than ever.

If your work involves balancing, do it the *modern* way—with Gisholt DYNETRIC Balancing Machines. Here's unrivaled speed that enables you to locate and measure unbalance in a matter of seconds—unequalled accuracy, capable of detecting vibrations as small as .000025".

Gisholt Balancers are available for handling all kinds of rotating parts, from a fraction of an ounce to many tons. Write us for a copy of the booklet STATIC & DYNAMIC BALANCING.

DYNETRIC BALANCERS

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

LONG LIFE!

1

All gears in Gisholt turret lathe transmissions are high carbon alloy steel, precision ground after heat-treatment to assure long wearing quality. All shafts turn on antifriction bearings, with pressure spray lubrication. Headstock is cast integral with bed for extreme rigidity—to maintain accurate, permanent alignment.

2

Gisholt's thick, block-type ways are automatically pressure lubricated. Made of SAE 52100 tool steel, they are deep hardened to 64-66 Rockwell C and then finish-ground for exact alignment with the spindle. On top, bottom and both sides, they present a bearing surface that is virtually wear-proof—accurate for years to come.

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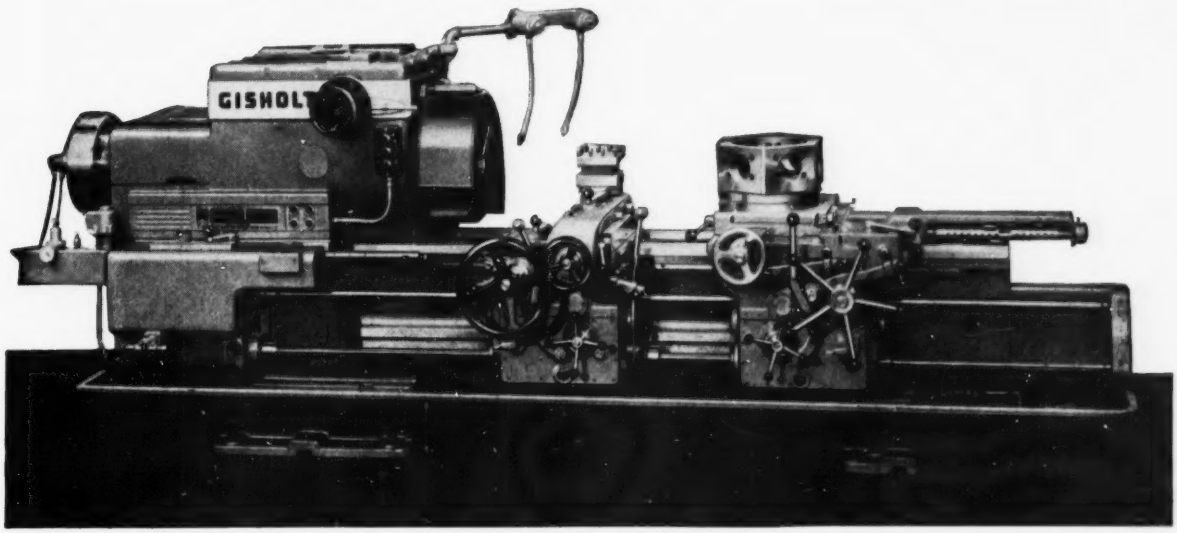
Aprons are fully enclosed, all working parts protected and operating in a continuous cascade oil bath. Alloy steel gears and shafts are mounted on antifriction bearings. Positive serrated feed and traverse clutches cannot slip or drag. Safety shear pins protect feed and traverse mechanism against overload and accident.



You'll find all the speed and easy operation you want in these new Gisholts. But you want long life, too. Here's the lasting accuracy, freedom from repair bills and proved performance that protect your turret lathe investment for years to come.

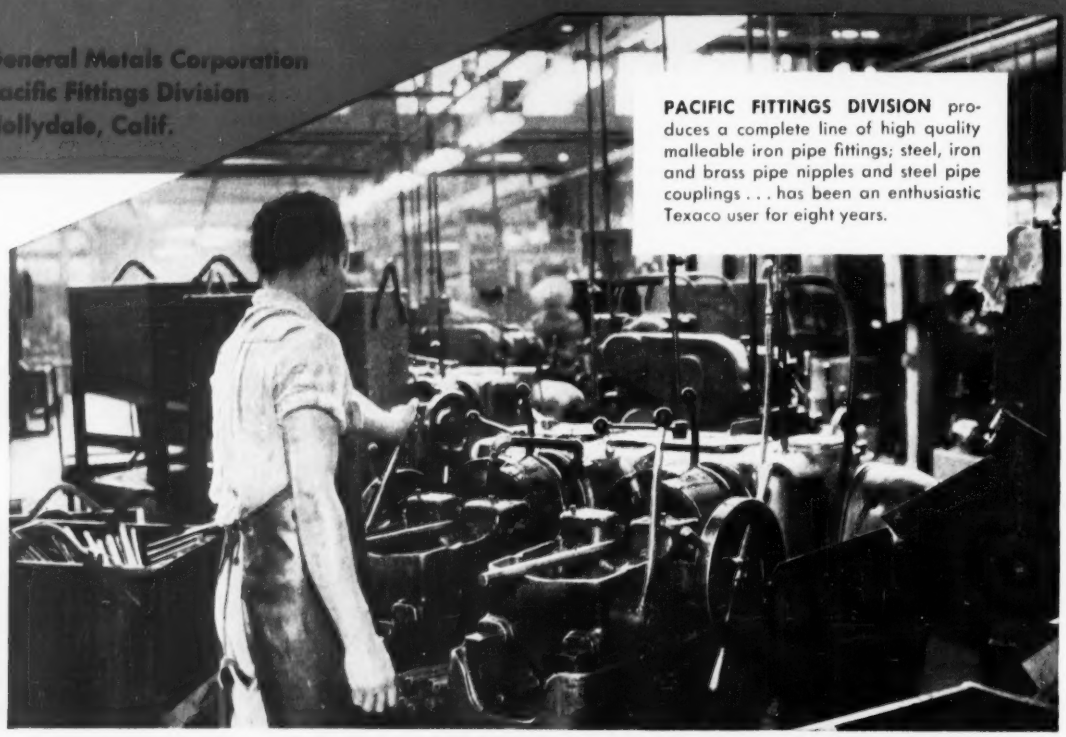
GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

"MOST HELPFUL IN KEEPING OUR PRODUCTION UP AND COSTS DOWN"...

General Metals Corporation
Pacific Fittings Division
Hollydale, Calif.



PACIFIC FITTINGS DIVISION produces a complete line of high quality malleable iron pipe fittings; steel, iron and brass pipe nipples and steel pipe couplings . . . has been an enthusiastic Texaco user for eight years.

PACIFIC FITTINGS DIVISION of General Metals Corporation—largest pipe fitting manufacturer on the Pacific Coast—has this to say about Texaco Products and Service:

"We've used Texaco exclusively for many years and with good reason. Texaco Lubrication Engineers have always worked closely with our production men and their recommendations have always been sound and practical.

"This, in combination with the uniformly fine quality of Texaco Products, has been most helpful in keeping our production up and costs down.

"For example, we are getting highly efficient performance and exceptionally long tool life on our automatic screw, tapping and threading machines with Texaco Sultex Cutting Oil A *as coolant—and* Texaco Cleartex Oil DD *as machine lubricant and hydraulic medium."*

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. And Texaco Lubrication Engineering Service will gladly guide you in their selection and proper use. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

TUNE IN . . . METROPOLITAN OPERA radio broadcasts every Saturday afternoon. See newspaper for time and station.

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By LORING F. OVERMAN

Washington Maintains Heavy Influence on Business, Industry, and Individuals

THE first week in January brought another session of Congress, at which the President's broad legislative program, as well as some pet ideas of Senators and Congressmen, will be under consideration. A proposal to cut the defense-spending budget to $38,000,000,000 was one idea with serious implications machinery-wise. The Department of Defense had announced the rules for its machinery leasing program. An overhaul of the entire tax structure was in the making. All in all, the turn of the year indicated that Washington would again exert a powerful influence over the affairs of business, industry, and individuals.

Federal Income to be Down $5,000,000,000

If all efforts at budget balancing can be as successful as the first major effort announced by the Administration, all will be well. On the one hand, a $5,000,000,000 loss in revenues is represented by the expiration on December 31 of the excess profits tax and the reduction of 10 per cent in individual income taxes. On the other hand, the Department of Defense proposed a 1954-55 defense budget of a full $5,000,000,000 below the $43,000,000,000 anticipated for fiscal 1954, which ends June 30.

Defense Department people promise that in trimming the huge sum from the budget, little muscle will be lost. Instead they plan to trim the fat away—for example, the back-of-the-lines personnel and the food, clothing, and shelter needed to support them. This is taken to mean that money for any needed expansion—including machinery and equipment—can still be squeezed from the appropriation by wringing water out of the remainder of the program.

"Is it really necessary?" will, more than ever, be the yardstick followed. Gone are the days, Administration spokesmen say, when a proposed expenditure was a "sacred cow" merely because it was earmarked for defense. Many will find this program painful, but it is the program on which the present Administration was voted in and now the chips are down.

Trouble Spots

One of the obvious things about politics is that the party in power must remain in the saddle in order to put its program into practice. With alternate election years for the House and Senate, a party can remain in office only through a certain amount of give and take. In the present instance, staying in office may require some "giving" in the hope of winning votes for Congressmen next fall.

Taft-Hartley legislation may have to be eased, and there is a move afoot to increase the minimum wage to a dollar, more or less, and to increase the coverage of the Fair Labor Standards Act, under which minimum wages are fixed for workers engaged in interstate commerce. It may be necessary to give ground on farm supports, and on social security in the hope of lining up voting strength. The coming months will be of tremendous importance to the business and political future of this country, and legislators will welcome comments and suggestions from folks back home.

Machine Tool Lease Order Issued

Department of Defense Directive 4215.13, dated December 17, 1953, outlines the conditions under which government-owned machine tools may be leased for the production of non-defense goods. Under terms of the directive, if machine tools are to be used more than 75 per cent of the time in military production, they may be leased by the Services to civilian contractors without reference to Assistant Defense Secretary Thomas. Any proposal to lease tools that would be used less than 75 per cent of the time for the military, or entirely for civilian production, must be approved.

Allocations Still Needed for Defense Materials

Surprising to many is the information that more than 900 directives are being issued each month by the Business and Defense Services Administration to take care of essential military orders. The figure was recently released as reason for a simplified defense materials system, to take care of present needs and to have machinery ready for instant use "in case." Proponents of the system feel that it would help spread materials orders to many suppliers, keeping such channels open in the event that the cold war should warm up. Otherwise, such orders might gravitate to a single firm, which would be swamped in the event of an emergency.

BDSA Personnel Changes

Several personnel changes within the Business and Defense Services Administration have been announced. Harry Smith of the Aluminum Company of America succeeds Henry J. Wallace as Assistant Administrator in charge of minerals and metals. Everett G. Fahlman, of the Permold Corporation, becomes chief of the Aluminum and Magnesium Division. In another change, Clarence R. Burrell of the Tool Steel Gear and Pinion Co., Cincinnati, Ohio, succeeds Victor A. Spoehr as Chief, General Components Division, BDSA.

Machinery Sales Down, Profits Up

Third-quarter machinery sales for twenty-seven large corporations listed by the Federal Reserve Board showed a $6,000,000 drop from the second quarter, but were 15 per cent better than the third period of 1952. Net profits were 8 per cent better than a year ago. Sales for 200 corporations were off a seasonal $879,000,000 from the second quarter, but were 30 per cent better than in the third quarter of 1952.

The Federal Reserve Board's Index of Industrial Production—now figured with 1947-49 as the base years (100) instead of 1935-39—brings the index into line with general government statistical procedure. The new base brings the index closer to reality than the old one, and seventy-five items have been added to the index. The revision emphasizes the extent to which the old index underestimated the rise in production since 1947.

SIGN OF PRECISION

HARDINGE means precision in its truest sense . . . not a loosely used term applied to any machine.

Precision Construction — Hardinge machines are designed and built for profitable high speed, easy operation with sustained accuracy and low tooling cost.

Precision Operation — Operators of Hardinge machines can consistently produce precision parts — and operating simplicity permits unskilled workers to produce to close tolerances without expensive tooling.

Two Lines of Hardinge Precision Machine Tools for:

Precision in the Tool Room

Designed for tool room needs, Hardinge High Speed Tool Room Machines: HLV Tool Room Lathe, TM or UM Milling Machines, and DV59 Lathe, provide extreme accuracy, high spindle speeds, and easy operation for precise, accurate results.

Precision in Production Departments

Cutting production costs to keep selling prices in line calls for these faster, more accurate, easier-to-operate Hardinge machines . . .
HC Chucking Machine, HCT Chucking Machine with Production Threading Head, and DSM 59 Second Operation Machine.

To specify Hardinge for the precision performance you want, write for complete descriptive bulletins.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

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MACHINERY
FEBRUARY 1954

What to Do with Subversives in Industry

THE Senate and House investigations into the activities of Communists in the Government have created a furore that is unlikely soon to subside. However, after all the pros and cons relative to the tactics employed by certain members of the investigating committees, the fact remains that there have been Communists in high places and that any of them still on the Federal payroll should be ferreted out.

What applies to Government agencies should also apply to all industrial plants engaged in national defense work. Spies and saboteurs could be in a position to obtain details concerning secret weapons on which our existence could someday depend.

The General Electric Co. is, therefore, to be commended on a recent announcement that the company will immediately discharge admitted Communists and suspend all workers who refuse to testify under oath about their allegiance when queried in public hearings conducted by a competent Government authority. The Government has been called upon to establish an independent security agency that would give suspended persons the opportunity to be cleared of false accusations and then reinstated in their jobs. Present governmental regulations keep "security risk" employes from classified work and information, but the General Electric Co. believes this policy is not adequate.

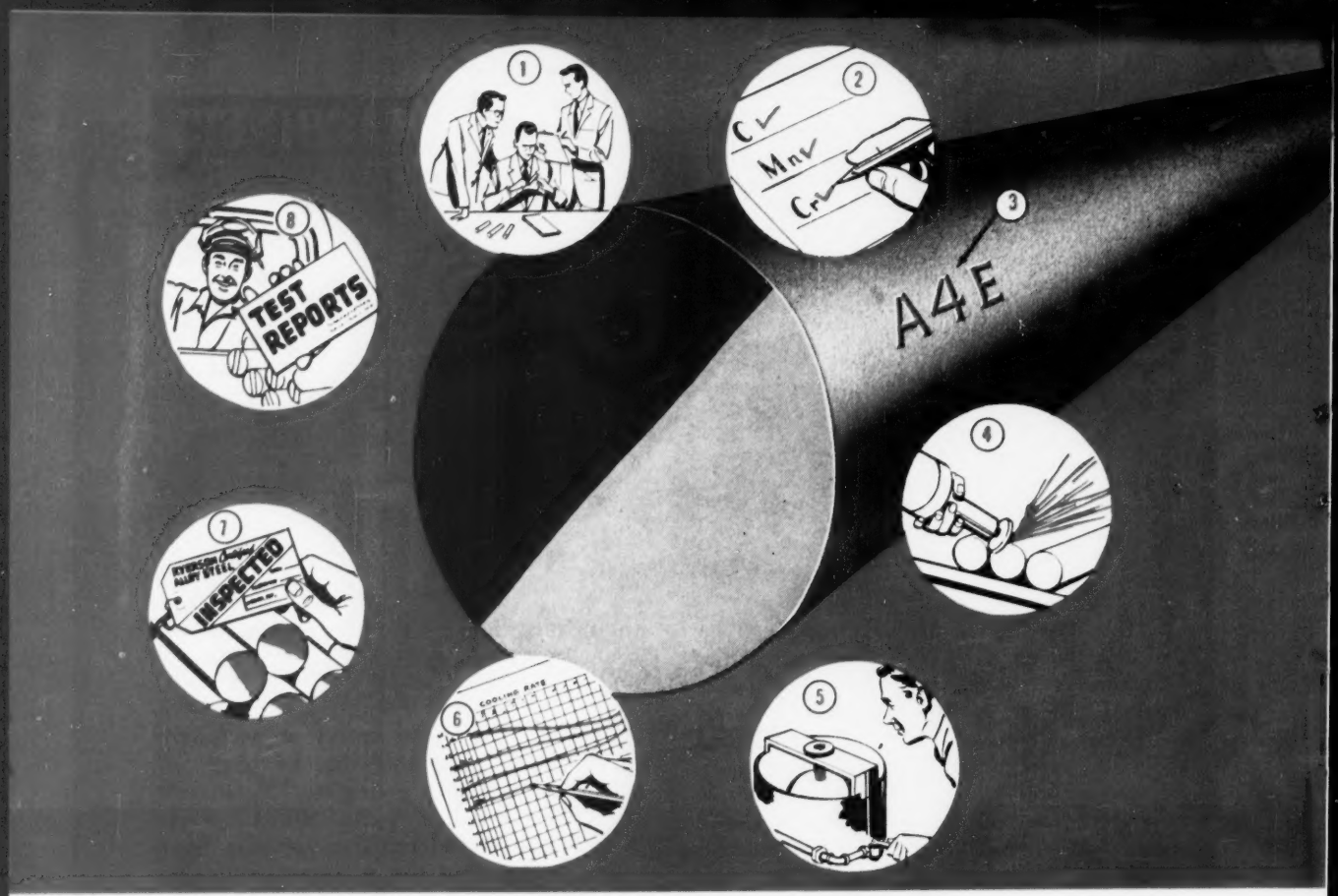
Anyone who asserts before an accredited investigating committee that he might incriminate himself by giving truthful answers concerning possible "party" affiliations can be definitely considered a Communist. Statements to the effect that a citizen's rights are being violated by such interrogation are simply nonsense. A real American is always ready to testify as to his political affiliations, religious beliefs, fraternal connections, and other matters actually his personal concern.

Investigations into subversive activities should be conducted on a high plane, regardless of the inquisitions in countries under Red domination. We must always remember, however, that well-meaning persons who in past years were deluded by the will-o'-the-wisps of Communism but who have now renounced their faith in that insidious doctrine, should be considered loyal citizens. Witch-hunting is a despicable practice and should not be tolerated.

National preparedness demands that anyone unwilling to certify his loyalty to his native or adopted country has no place in a defense plant.

Charles O. Herb

EDITOR



How Ryerson 8-step quality control

Protects Your Alloy Purchase

Are you sure of the alloy steel you buy? Sure of type and quality—sure of what the steel will do?

When you call Ryerson for alloys you can be sure—because Ryerson, and only Ryerson, takes eight separate and distinct steps to protect you against the many slips that can occur before the steel you order reaches your plant.

First, to assure you alloys of highest quality, we carefully select each heat to be carried in Ryerson stock [1]—verify the analysis as soon as a heat is received. [2] Next, for permanent identification, we stamp each bar with its particular heat symbol [3]—color mark it according to type. Then, to guard against mixed steels, we spark test every lift of bars from each heat. [4]

Meanwhile, we test a sample of every heat for hardenability [5] and interpret the test results for you. [6] So, finally, when you call Ryerson for alloys you can be sure. Tested steel—racked separately by heats—is prepared to your order; given a final inspection [7] and rushed to your plant. And with your steel (as-rolled or annealed), you receive complete test data [8] to verify quality and guide heat treatment.

This 8-point quality protection is yours at no extra cost. Just call your nearby Ryerson plant.

Principal Products: Carbon, Alloy & Stainless Steels—Bars, Structurals, Plates, Sheets, Tubing, Machinery & Tools, Etc.

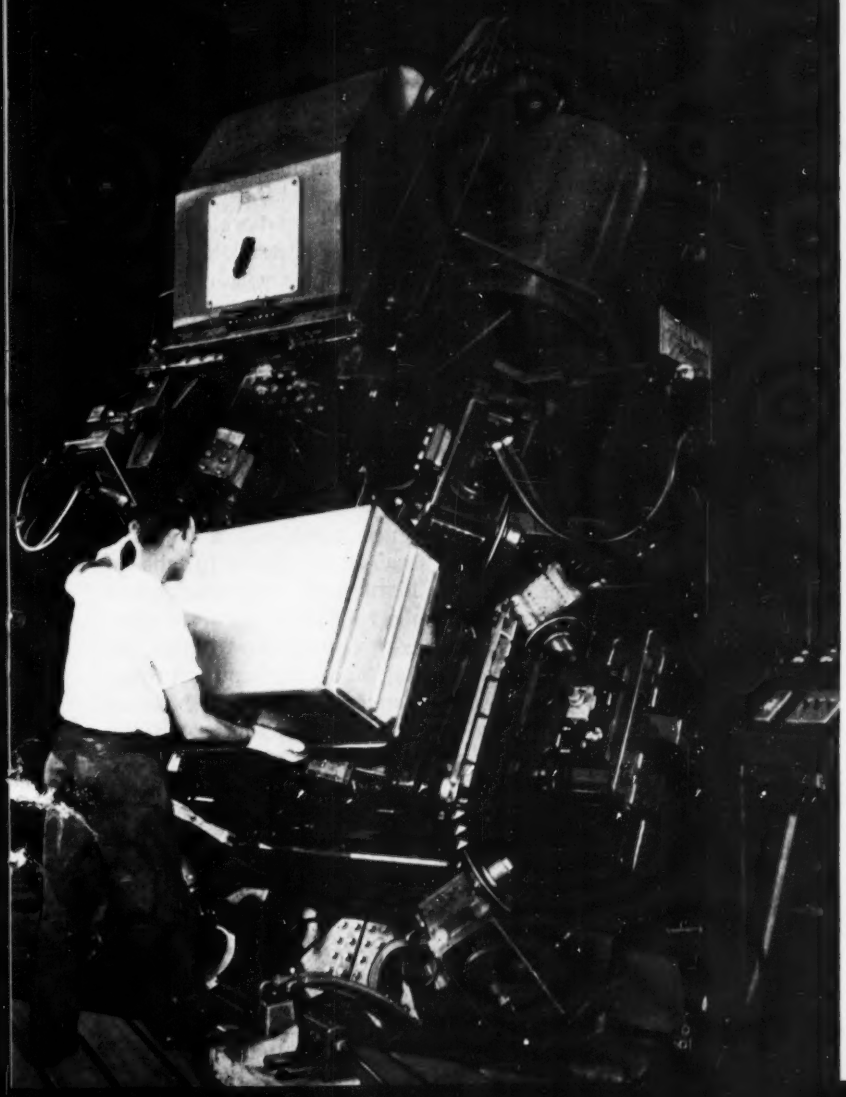
RYERSON STEEL

RYERSON CERTIFIED STEELS

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • DETROIT
PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Innovations in a Modern Refrigerator Plant

BY H. A. STUTZMAN
General Superintendent, Refrigeration
Hotpoint Co., Chicago, Ill.



Advanced ideas, techniques, and equipment have been incorporated in Hotpoint's new plant to permit the production of a refrigerator every forty seconds. Unique methods of making condensers and evaporators, and dehydrating cooling units, as well as unusual methods of welding, testing, and painting are described in this article

IMPROVED quality refrigerators can be produced at the rate of ninety per hour in the new Hotpoint 1,000,000-square foot refrigerator plant in Chicago. At this production rate, the yearly consumption of raw materials would include 60,000,000 pounds of steel, 2,000,000 pounds of aluminum, and 428,000 pounds of copper and stainless steel. To reduce the need for human handling to a minimum, the plant has been equipped with almost ten miles of conveyor lines.

Advanced ideas, lay-outs, and techniques, backed by the newest in production equipment, have been incorporated in this ultra-modern plant. Raw materials are received either by truck or rail and stored in an area on the extreme west side. An overhead crane is used to disperse these materials to their proper departments.

By allowing additional space in each department for raw materials, storage and rehandling problems are minimized. The main assembly conveyor line, which is 7000 feet long and carries all component

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MACHINERY
February 1954

Fig. 1. Steel radiating wires stacked in vertical magazine are automatically fed one at a time into comb of fixture passing below magazine.

parts, goes directly into each department instead of having the parts brought to the line. This reduces trucking and handling of parts, and production supervisors and control departments do not have to contact any other department, but meet main assembly line schedules right in their own departments.

A unique method of fabricating condensers is employed. This set-up permits a close tie-in with the main assembly line, and requires a minimum floor space. An operator seated above a rectangular-path, condenser assembly power-indexing conveyor, Fig. 1, stacks pre-cut and straightened steel radiating wires, 1/16 inch in diameter, into a vertical magazine. As a rectangular fixture on the conveyor track passes below the magazine, the wires are raked one at a time into a comb in the fixture. A spring-loaded lock prevents more than one wire from entering the fixture comb at a time, and limits the number fed into the comb to 100 wires.

When one side of the fixture has been loaded with 100 radiating wires, another operator places a preformed coil of copper-brazed steel tubing on top of the wires. The condenser assembly fixture then passes beneath a second vertical magazine, where 100 more wires are fed on top of the coil. This assembly process requires only four seconds. It is planned to further mechanize the set-up by providing hopper feeds for the vertical magazines.

Loaded condenser assembly fixtures are indexed directly into the National 600-K.V.A. press type, automatic welder shown in Fig. 2. This hydraulically operated spot-welding machine is equipped with 200 electrodes, and the fixture is indexed thirteen times within the machine to join each of the 200 wires to the thirteen straight sections of the condenser coil. The 2600 separate spot welds are completed in a fifteen-second cycle. After welding and forming of the tube ends, the condenser is tested for leaks and placed on the assembly conveyor.

In making evaporators for the refrigerators, aluminum-alloy strip stock 0.032 inch thick is fed into a specially designed combination machine that automatically straightens the strip, shears it to the required blank size, and stacks the blanks. Struthers Wells 150-ton press brakes are then employed to pierce, emboss, and flange the flat blanks. Cooling coils of aluminum tubing are placed on the cleaned blanks, with brazing strips between the tubing and blanks, and the sub-assemblies are passed through a brazing furnace. Brazed evaporators are pickled, rinsed, air-dried, and inspected.

Fig. 2. A total of 2600 spot welds are made in fifteen seconds on this automatic welder in joining radiating wires to condenser coil.

Fig. 3. Combination bending and welding machine forms evaporator and joins back. Operator is placing evaporator back on bender ram.

Although forming of the evaporator and assembly of its back formerly required three or four operations on several different machines, it is now done on a single machine—a Struthers Wells tangent bender combined with a 60-K.V.A. spot-welding head made by the Resistance Welder Corporation. The brazed evaporator blank is placed in the tangent bender, locating from gages built in the bending dies, and the evaporator back is positioned on the ram of the bender, as seen in Fig. 3.

When the operator presses a button to start the fully automatic forming and welding cycle, the ram on which the evaporator back has been placed is lowered onto the brazed blank, and the two side-bending wings are pivoted upward, Fig. 4, to form the top and bottom surfaces of the evaporator. Then, secondary bending wings fold the ends of the brazed blank toward each other to form one side of the evaporator.

With the secondary bending wings remaining in position, the welding head is automatically lowered and spot welds along the seam of the bent blank are made. The welding head has seven electrodes which make six spot welds on the first stroke, and then seven more welds after the head has been indexed. When the welding electrodes and bending wings have retracted, the evaporator is removed from the ram, as seen in Fig. 5. Total forming and welding time is only fifteen seconds.

Since the formed part does not have to be removed to a separate machine for welding, substantial reductions in production costs are possible. Also, only one operator is required with this combination machine, and less floor space is needed. Another advantage is that the evaporator is held firmly to the required size by the bending wings during welding, thus eliminating the need for overbending.

Final sizing of the evaporator and crimping of the back is done simultaneously on a Struthers Wells combination machine. The work-piece is placed over a collapsible fixture that is hydraulically expanded to stretch the evaporator to the required size. At the same time, the work is ro-

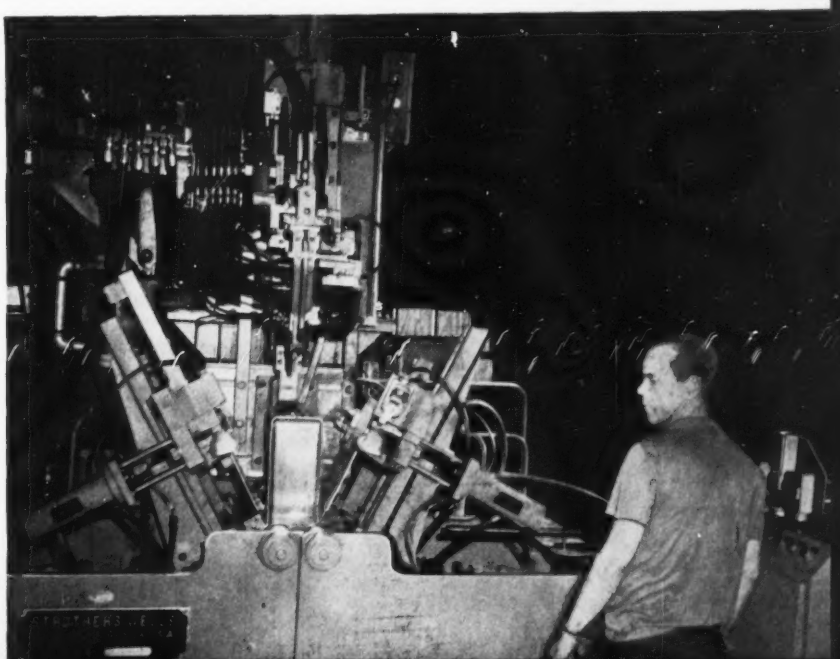


Fig. 4. Side-bending wings are pivoted upward to form the top and bottom surfaces of evaporator. Secondary wings fold the edges to form one side.

Fig. 5. After joining ends with thirteen spot welds, evaporator is removed from ram of bender. Forming and welding cycle requires only fifteen seconds.

tated and rollers move in and out to crimp a flange on the back around the evaporator sheet.

Header assemblies and copper-aluminum connectors are joined to the evaporators by latest argon-welding techniques in a completely automatic cycle on machines such as the one seen in Fig. 6, which were designed and built by Company engineers. The machines employ General Electric power units and Heliarc welding heads for the argon gas-shielded, non-consuming tungsten electrode arc process. The operator simply places the assembly on a rotating fixture, presses a button, and removes the welded evaporator when the cycle is completed.

With this process, stainless-steel reinforcing tubes or inserts do not have to be placed inside the aluminum tubes prior to welding. Since neither flux nor filler wire is employed, there is minimum risk of inclusions in the welds and no spatter to clean. Fast welding rates are possible, and smooth, high-quality welds are consistently produced.

Completed evaporators are given a pressure leak test prior to anodizing them. High-pressure air combined with Freon is injected into the evaporator. This pressure remains in the evaporator until it is ready for assembly on the refrigerator. An automatic machine designed for Hotpoint by the Meeker Co. is used for anodizing. After anodizing, the complete evaporator is inspected, and a G-E detector is used to show any minute leaks that may exist in the tubing or welded joints. This inspection is done in a pressurized room to be certain that no contaminated air influences the leak detector.

The main assembly conveyor line starts in the evaporator department and moves to the condenser and mounting frame assembly department, where these assemblies are picked up. Then it advances to the tube fabricating department where it picks up the heat exchanger and other tubing. The heat exchangers consist of a copper capillary tube (10 feet long and having an inside diameter of approximately 1/32 inch) for metering the refrigerant, soldered along the outside of a copper suction tube (1/4 inch in

Fig. 6. Special machine using argon gas for shielding and a non-consuming tungsten electrode arc for welding header to evaporator.

diameter by 127 inches long). Soldering is accomplished on an automatic machine that heats the tubes by means of gas flames, applies flux, and solders the tubes together, the lead-tin solder wire being fed from an overhead reel as the tubes are fed below it. The soldered tubes pass through a water spray that washes off the excess flux. The extra length of the capillary tube is wound around one end of the suction line tube on the special winding machine shown in Fig. 7.

When the last joint is brazed, the cooling unit is charged with high-pressure dry air and sent through a washer to remove any dirt or materials from the welded joints. To test for any leaks that may be present, the unit is submerged in a high-pressure tank for one and a half minutes. As it passes through the tank, the operators watch for tiny air bubbles which, if present, will rise to the top of the tank. As the unit emerges from the test tank, it goes to an automatic blow-off device that dries it.

The cooling units now move to what is probably the most critical process in the plant, dehydration. This process removes practically all the moisture that is present in the cooling unit. The dehydration system employs extremely high vacuum and a drying oven.

After the dehydration operation, the cooling unit continues on a conveyor line into a hood where there is a low concentration of helium. If the unit leaks, helium gas is sucked into the unit, due to the high vacuum. A very sensitive electronic mass-spectrometer is used to detect leaks so small that it would take two hundred years for one ounce of refrigerant to leak out. The cooling unit is then charged with oil and Freon, painted, and carefully tested.

Fabrication of refrigerator doors, cabinets, and liners is done in the company's converted storage area of the electric range plant. Most of the raw steel is run through a leveler and then cut into the required sizes. The steel used for refrigerator doors goes into three Verson 400-ton presses, and then proceeds to special flanging, piercing, and welding machines. Cabinet steel is fed into a notching press, then through a Yoder rolling machine to form flanges along its edges. The preformed cabinet sheet is crowned and bent to the required U-shape on the Struthers Wells double-wing tangent bender seen in Fig. 8. In this operation, radial edges of the flanges are smoothly bent to the desired radius without need for notching.

Fig. 7. Portion of capillary tube extending beyond suction tube of heat exchanger is wrapped around end of suction tube.

Sheet steel for the refrigerator liners is blanked, pierced, and embossed on another 400-ton press. After flanging and bending the liner wrapper into a U-shape, it is joined to the preformed top and bottom sheets in a completely automatic cycle on a 750-K.V.A., six-wheel resistance seam welder, Fig. 9, built by the Resistance Welder Corporation. The wrapper is clamped on a work-holding fixture, and top and bottom sheets are slid into position, as shown, with their preformed curved edges fitting over those on the wrapper. The top and bottom sheets are clamped by hydraulically actuated side-acting plates.

When the starting button on this "octopus" welder is depressed, the six wheels are automatically fed into position (tangent to the curved edges on the work-pieces), as seen in Fig. 10, and traversed to simultaneously seam-weld both top and bottom sheets to the food liner wrapper. A completed liner is shown being removed in the heading illustration.

Steel surfaces of the food liners are prepared for porcelain finishing by passing through an automatic spray pickling machine. After pickling, the food liners move into the vitreous enamel department by conveyor. Liners are dipped in the ground coat and pass through an electric drying tunnel, using infra-red lamps for the drying process. The liners are then transported to the firing chains and sent into an electric furnace. After firing, the liners are placed on a conveyor which carries them to the white coat spray booth.

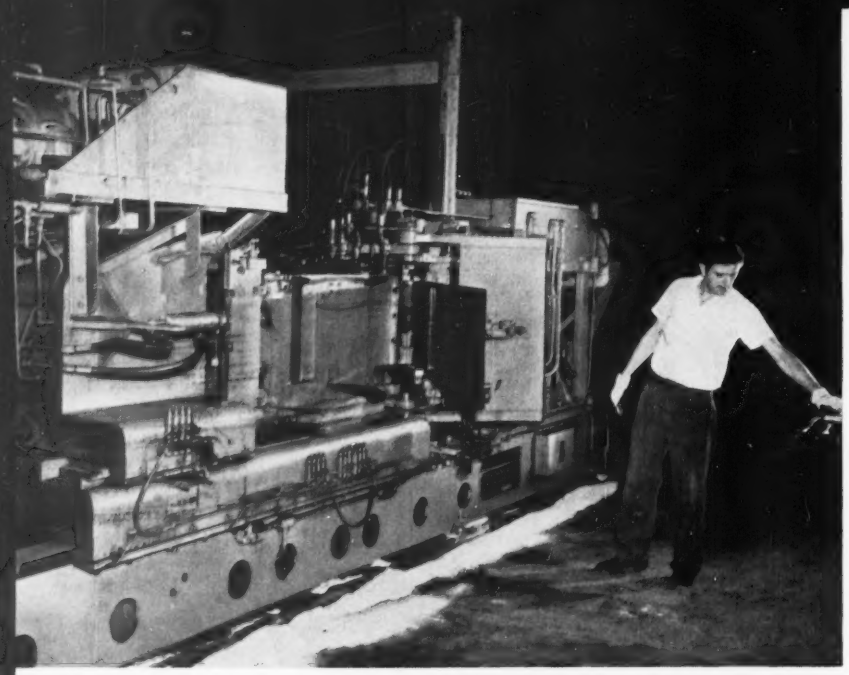


Fig. 8. Sheets having edges previously flanged in a roll forming machine are formed to the required shape for cabinet shells on tangent bender.

The liner continues through another infra-red heat tunnel for drying. After drying, some areas are wiped. Liners are next hung on the firing chains and go to the furnace for the burning of the finished coat. The liners are then removed from the firing chain and placed on the transport conveyor which delivers them to refrigeration assembly in the main plant.

Refrigerator doors and cabinets are passed through a six-stage washing process consisting of an alkali wash, hot water rinse, cold water rinse, phosphatizing, cold water rinse, and chromic acid rinse. The parts then pass into a drying oven, and a flow-coat machine automatically applies a resin primer coat. A vapor chamber allows the doors and cabinets to drain.

The parts are dried in an infra-red bake oven. Another spray booth is then employed to reinforce the primer coat. After the doors and cabinets are again baked and allowed to cool for twenty minutes, they are sent to a sanding booth where the primer coat is sanded and the parts are tack-wiped.

A screw type grouping conveyor equipped with special work-holding hangers is employed to automatically invert the parts between priming and finish-painting operations and space them the desired distance apart. These special hangers and the grouping conveyor eliminate the need for manually transferring and inverting the parts, makes a second set of work-holders unnecessary, and saves floor space that would be required to transfer the parts. Each work-holder accommodates a complete unit of painted parts,

Fig. 9. Top (in operator's hands) and bottom sheets are placed in position at the ends of the refrigerator liner wrapper prior to automatic seam welding.

Fig. 10. Six wheels on this resistance seam welder are automatically fed into position tangent to the curved edges on work-pieces.

consisting of a refrigerator cabinet, the door, the toe-plate, and the inner door panel.

Finish-painting of these parts is accomplished by means of the Ransburg No. 2 electro-spray process. The set-up consists of two stations, illustrated in Fig. 11, with an automatic indexing unit between stations. The parts to be coated are grounded electrically by their hangers, and the paint particles are charged with 90,000 to 100,000 volts of electricity. The paint is sprayed from bell-shaped spinning atomizers that rotate at about 900 R.P.M.

A pump supplies paint through the hollow drive-shaft of the atomizer, and rotation feeds the paint at a uniform rate through the atomizer to its outer edge. Atomization occurs under the influence of the electrostatic field, producing a spray pattern of electrically charged particles that are attracted to the moving, grounded work-pieces, thus giving a more uniform coating. Also, a substantial saving in paint is realized since all of the paint is deposited and there is no over-spray to be exhausted. No compressed air is used in this painting system.

As the parts approach the first station, they are spaced on 56-inch centers. The grouping conveyor automatically changes the space between work-holders to 32 inches before they reach the first station. The first station is equipped with two triple atomizer units on each side for painting opposite sides of the cabinets.

Between stations, the spacing of the cabinets is increased enough to permit indexing each work-holder 90 degrees, in order to present the other surfaces for painting at the second station. Center distance between the work-holders is maintained at 36 inches as they pass through the second station. Side atomizers at the second station paint the inner door, the large door, and the toe plate; and bottom atomizers paint the inverted top of the cabinet. As soon as the work leaves the second station, the space between hangers is again increased to 56 inches and they are indexed to their original positions.

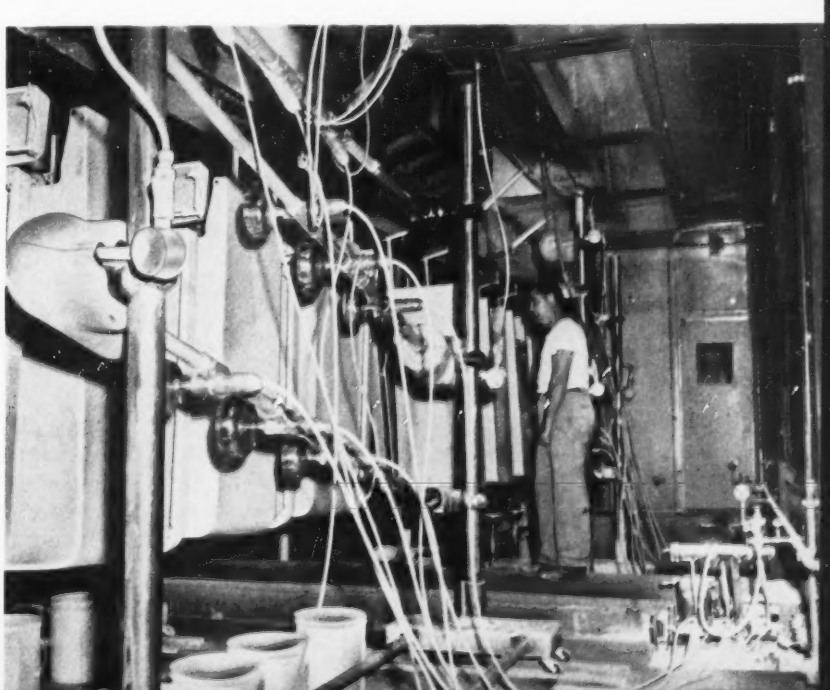


Fig. 11. Final finish is applied with an electro-spray process system. Paint particles are electrically atomized and charged, and the work is grounded.

Mass Production of Anti-Friction Freight Car Axles

In preparing railroad freight car axles for the application of roller bearings, automation, modern methods, and special machine tools are being employed. Among the innovations are contour-turning both ends of the axle simultaneously and centerless grinding of the 1100-pound forgings

By WILLIAM B. CHELLIS, Assistant Works Manager
American Car and Foundry Company
Huntington, W. Va.

ALTHOUGH anti-friction bearings are standard equipment on most railroad passenger cars and locomotives, they have only recently been applied in quantity to modern freight cars. Among the advantages of anti-friction freight car axles are easier starting, smoother rolling, faster speeds, less jolting of the freight, and eliminating the problems of hot-box delays and frequent maintenance.

The application of roller bearings to freight cars at high-production rates is currently under way at the Huntington, W. Va., plant of the American Car and Foundry Company. This is believed to be the first high-capacity installation of its kind in the world, and the only one where the preparation of railroad freight car axles for roller bearings can keep pace with a freight car production line. At present, this plant is engaged in the production of 600 roller-bearing equipped, covered hopper cars for the Atlantic Coast Line Railroad.

By employing the latest developments in automation, modern methods, and special machine tools, it is possible to produce anti-friction freight car axles at the rate of ninety per eight-hour shift. In preparing railroad freight car axles for the application of roller bearings, much closer tolerances must be maintained than in producing conventional friction type axles. Consequently, special techniques and machinery had to be developed. Among the innovations employed are contour-turning both ends of the axle simultaneously and centerless form-grinding. This is believed to be the first application of centerless grinding to such large, heavy work-pieces.

Roller-bearing freight car axles of the type now being produced at ACF's Huntington plant are made from A.I.S.I. C1040 steel forgings.

Each forging is approximately 88 inches long, with a maximum diameter of 8 1/2 inches, and weighs about 1100 pounds. The heavy, unwieldy axles are handled easily and quickly by means of a Cleveland Tramrail system of overhead monorails. The monorails are equipped with both hand- and motor-propelled electric hoist carriers to move the axles directly to the various operations, thus eliminating any manual handling.

Forgings are received from the supplier cut to length and centered, with their wheel seats and journal surfaces rough-turned, and that portion of the axles between the wheel seats finish-turned. To correct the centers (which may have been damaged during rough machining, shipping, or handling) and insure concentricity in subsequent machining, the forged axles are recentered on a Niles double-end centering machine, Fig. 1.

The forging is lowered into the centering machine from an overhead hoist, being guided into the required location by means of steel plates and pipes fitted to the bed of the machine. Each end of the axle is power clamped by a pair of V-blocks, and both heads of the machine are hydraulically fed toward each other until the rotating center drills have reached the desired depth.

Wheel seats, dust collars, and journals of the forged axles are semi-finish-turned on Betts double-end, center-drive lathes, such as the one seen in Fig. 2. Both ends of the axle are turned simultaneously, the lathe being fitted with two carriages, each carrying three high-speed steel tools. The forging is supported between centers and rotated by a three-jaw center-drive hydraulic chuck, and three cylinders are connected by a manifold to balance the pressure exerted by each jaw. The chuck is operated by a hand lever, which, when pulled, tightens a band wrapped around the periphery of the external chuck member.

About 3/16 inch of stock is removed from the various surfaces in this operation, with the work rotating at 60 R.P.M. (130 feet per minute on the maximum diameter) and the carriages fed hydraulically toward each other at the rate of 3 inches per minute. As shown in Fig. 3, a close-up view of the carriage at one end of the lathe, a special tool-block is employed to accurately position the gage-ground tools with relation to the work for turning the different diameter surfaces simultaneously. Passages are drilled through the tool-block to direct the coolant on the cutting edges of the tools.

A similar double-end, center-drive lathe is employed to finish-turn the wheel seat on each end of the axle. The diameter of the wheel seats is held within plus or minus 0.001 inch of the required size in this operation. Only one lathe is required to finish-turn the wheel seats on ninety axles per eight-hour shift, while two lathes are employed to semi-finish-turn the wheel seats, dust collars, and journals on an equal number of forgings.

Both ends of the axles are countersunk,

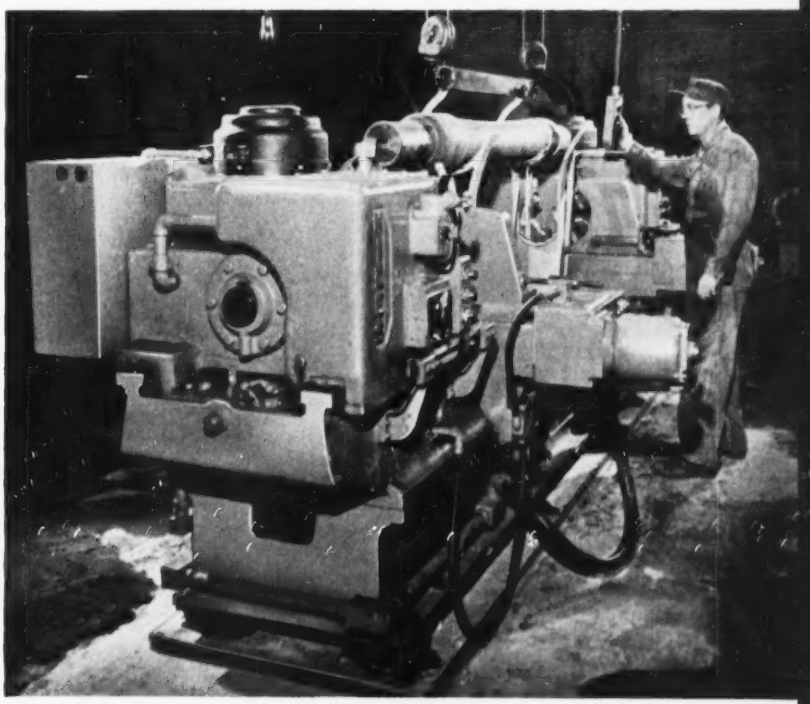


Fig. 1. Both ends of forged steel axle, 88 inches long and weighing 1100 pounds, are center-drilled simultaneously on this double-end machine.

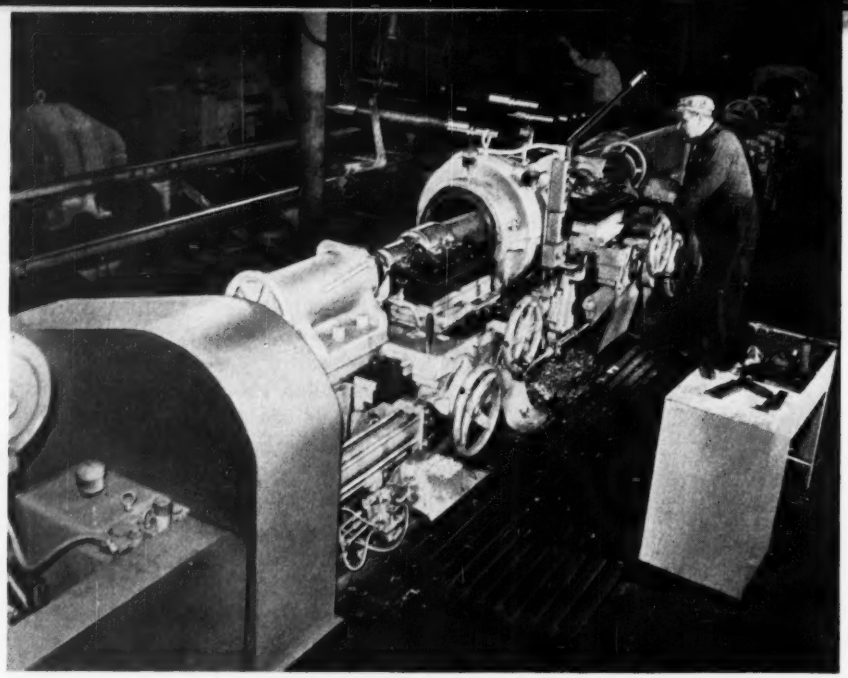


Fig. 2. Double-end center-drive lathe is employed to semi-finish-turn the wheel seats, dust collars, and journal surfaces on axles.

drilled, and tapped on a Baker Brothers automatic two-way, three-station transfer machine, Figs. 4 and 5. Three holes are drilled and tapped in each end of the axle to permit subsequent mounting of the journal bearing end-caps. Axles are semi-automatically loaded into this machine, being manually rolled down from the storage rack seen at the right, and falling between the hydraulically actuated clamping jaws at each end of the machine carriage.

At the first or loading station, three holes are countersunk to a diameter of 1 1/8 inches and an included angle of 82 degrees in each end of the axle. When the axle has been automatically transferred to the second station, the six holes are drilled to depth and a diameter of 7/8 inch. At the third station, both ends of the axle are tapped, with 1 inch–8 threads per inch, and the part is automatically unloaded onto the storage rack seen at the left.

Motor-propelled electric hoist carriers on overhead monorails are employed to transfer the axles from the storage rack to either of two Monarch dual-carriage, Air-Tracer controlled lathes, Fig. 6. Dust collar and journal surfaces, as well as the adjoining fillets, on both ends of the axle are finish-contour-turned simultaneously on these machines. An air-operated work lifter, located between the ways at the center of the lathe bed, is employed to position the axle between headstock and tailstock centers. Work rotation, at 237 R.P.M., is accomplished by means of a drive-pin screwed into one end of the axle.

About 1/8 inch of stock is turned from the different surfaces, which vary from 5 1/2 to 8 1/4 inches in diameter and extend 14 inches from each end of the axle. The tolerance on the journal surfaces is plus or minus 0.001 inch on the required diameter.

Both of the tool-slides are mounted so that they move at a 45-degree angle to the machine centers. These slides are controlled by Monarch

Fig. 3. Close-up view of carriage at one end of lathe seen in Fig. 2. Special tool-block accurately positions the gage-ground tools with relation to axle.

Air-Tracers, such as the one seen in Fig. 7, which are proportional control type tracing devices that employ air gaging principles to actuate a four-way hydraulic valve in the control unit. The air flow in the circuit is controlled by a stylus-operated spool type valve in the tracing head. Thus, movement of the stylus by changes in the shape of the template increases or decreases the air flow and determines the direction and speed of the slide.

The tool-block on each slide is equipped with two tools having mechanically held, triangular carbide bits, one for contour-turning and the other for chamfering one end of the axle. During turning, the carriages are fed toward each other at the rate of 0.020 inch per revolution. Floor-to-floor time for this operation is eight minutes per axle.

Next, the dust collars, journal surfaces, and adjoining fillets are finished by centerless grinding. One end of the axle is in-feed ground to form on one centerless grinding machine, seen at the left in Fig. 8, while the other end is finished on a second machine, shown at the right. The axle is lowered by an overhead hoist onto a hydraulic positioning elevator, and is located

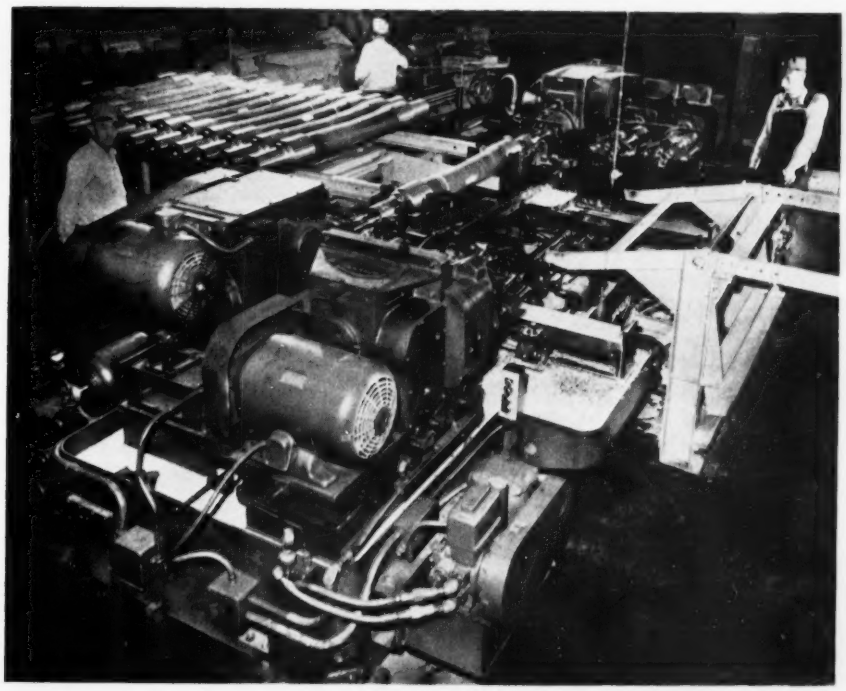


Fig. 4. Two-way transfer machine which automatically countersinks, drills, and taps three holes in both ends of forged steel axle.

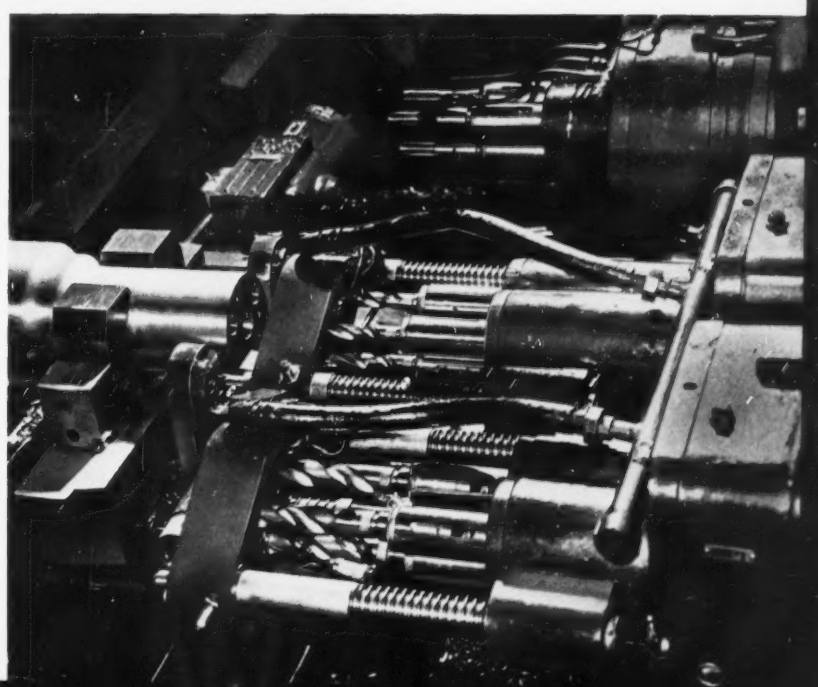


Fig. 5. Tooling at one end of the three-station transfer machine shown in Fig. 4, with countersinks in the foreground.

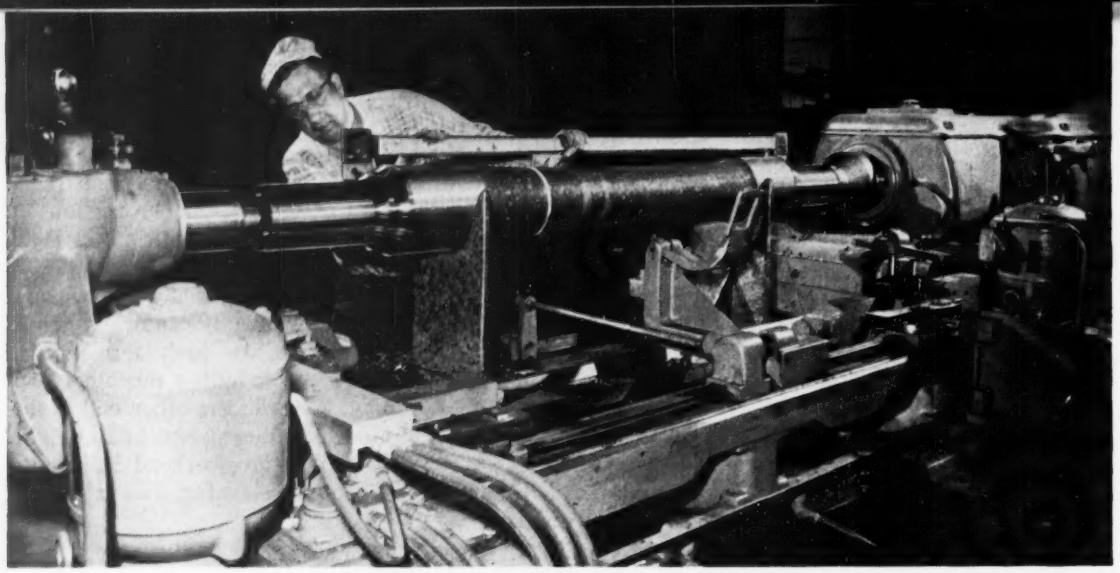


Fig. 6. Operator is here checking length after finish-contour-turning dust collar and journal surfaces, as well as adjoining fillets, on axle.

endwise by means of an air cylinder. Transfer of the axles between the two centerless grinding machines is automatic, the work-piece being raised hydraulically from the first machine and then rolling on the transfer rack to the second machine.

While a tolerance of only plus 0.0005, minus 0.0000 inch is specified for the journal surfaces, the axles are consistently being ground to within 0.0002 inch of the required size. Also, while a maximum surface roughness of 25 micro-inches r.m.s. is allowed, a finish between 12 and 15 micro-inches is being obtained. Automatic size control is obtained by means of a Federal unit, employing an Arnold continuous caliper type grinding gage, Fig. 9. The dial indicator, which shows the operator the size to which the part has been ground, is connected electronically to the machine controls, and the grinding cycle is automatically stopped when the required size is obtained.

Signal lamps are also provided to give the operator a visual indication of the size that has been ground. When the amber lamp becomes illuminated, the surfaces are 0.002 inch over size, and when the red lamp is lit, 0.001 inch over size. As a further size control, a positive stop is provided on the regulating wheel-slide of the centerless grinding machine.

During centerless grinding, the end of the axle being ground is supported between the grinding wheel, regulating wheel, and work blade. The other end of the axle is held on an outboard support, seen at the lower left in Fig. 10, consisting of two pedestal-mounted rolls —one power driven and the other an idler. Since the speed of work rotation is controlled by the regulating wheel, it is important that the power support roll rotate at exactly the same speed. This is accomplished by driving the power roll from a synchronous motor. In addition, it is essential that the outboard support move toward or away from the work exactly the same amount and at the same time as the regulating wheel, in order to insure parallelism of the surfaces

Fig. 7. Tool-slide at one end of lathe seen in Fig. 6. Movement of the tool is controlled pneumatically by stylus in contact with template, foreground.

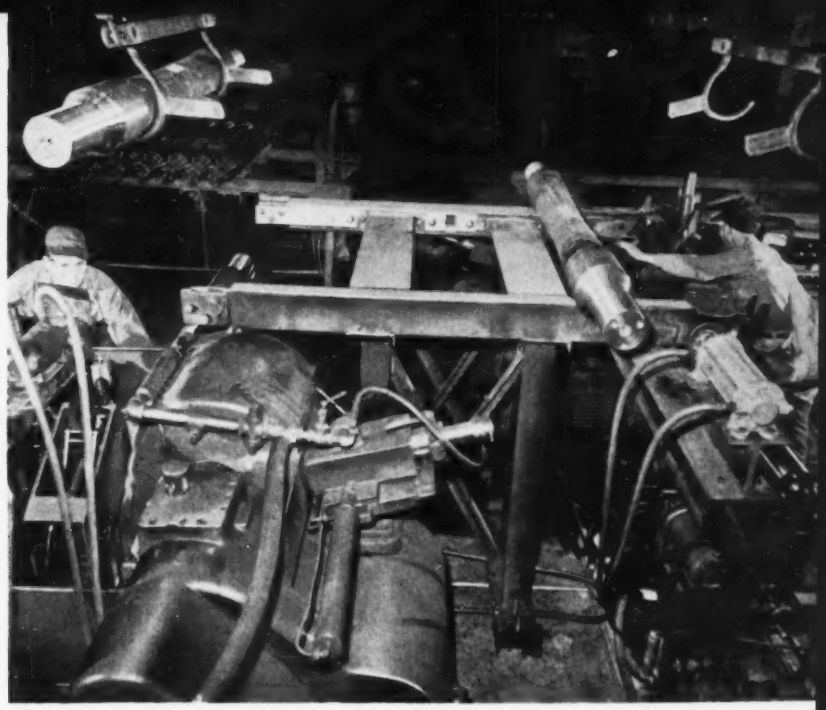


Fig. 8. Dust collars, journal surfaces, and adjoining fillets on axle are finished by centerless grinding. One end of axle is ground on machine at left, and other end on machine at right.

ground. This is accomplished by means of a hydraulic servo valve arrangement.

Abrasive wheels of the vitrified-bond, aluminum-oxide type and of 36 grain size are used for centerless grinding the axles, removing 0.015 to 0.020 inch of stock from various surfaces. Each grinding wheel, 13 1/2 inches wide, is trued or dressed hydraulically to the required contour by a diamond mounted on a cam-controlled slide that regulates the distance of the diamond from the axis of the spindle as the truing tool moves across the face of the wheel. It has been found that best results are obtained when the wheel is trued after grinding about twenty axles. The regulating wheel requires truing only when setting up the machine, replacing the wheel, or when the surface of the wheel has been damaged.

The regulating wheel is set at a slight angle with relation to the axis of the grinding wheel so that the axle is fed against an end stop prior to in-feed grinding. Both machines are equipped with magnetic separators to remove metallic particles prior to recirculation of the coolant. A production of ninety axles per eight-hour shift can be obtained from each centerless grinder.

Ground axles are transferred by overhead hoist to another storage rack, from which they roll to the Betts double-end burnishing machine, Fig. 11. In this operation, the surfaces of the journals are compressed, removing all turning and grinding marks and producing a smooth, glass-hard surface. The cold-working of the metal increases its physical properties.

During burnishing, the axle is driven from its ends by hydraulic pressure exerted on the headstock and tailstock centers. Stellite burnishing rolls, mounted on anti-friction bearings, are provided at both ends of the machine to exert pressures of about 400 pounds on both journals. The rolls are fed laterally, toward each other and along the 5 5/8-inch diameter journals by a rack and pinion, engaged by means of a slip clutch.

An automatic, motor-propelled hoist on an

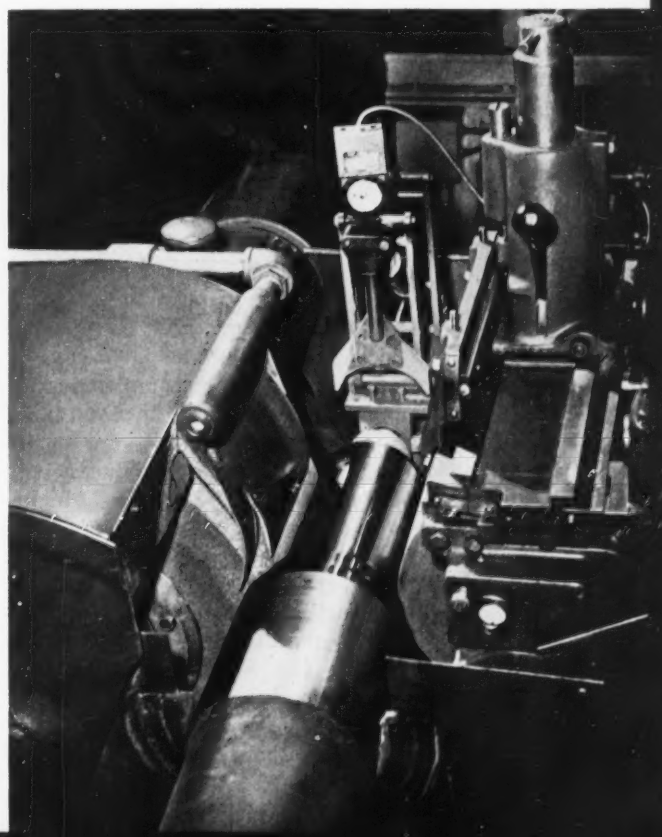


Fig. 9. Continuous caliper type gage provides automatic size control during centerless grinding. Journals are ground to within 0.0002 inch of required size.

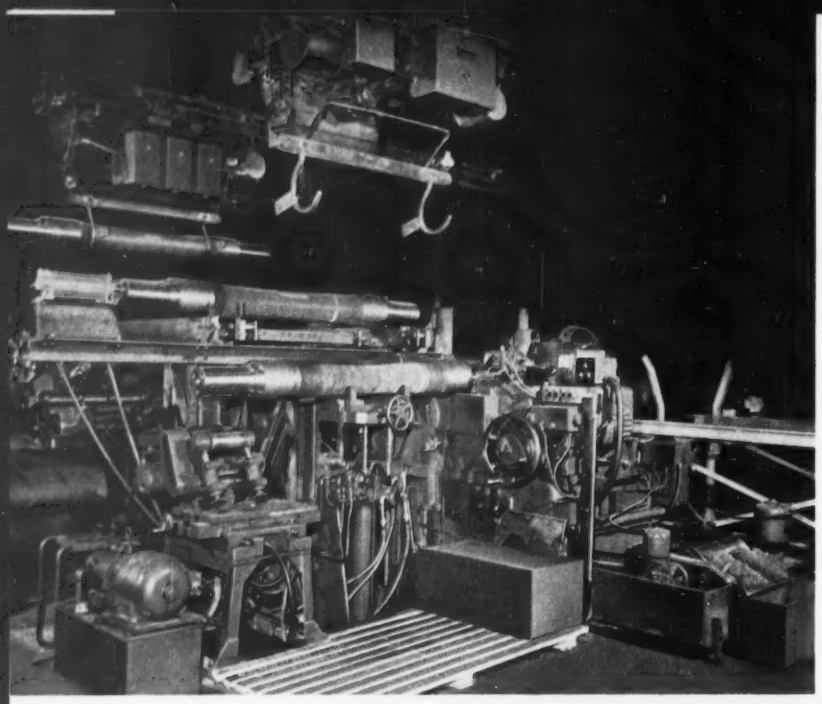


Fig. 10. End of axle not being ground is hydraulically lowered onto two pedestal-mounted support rolls, one power-driven and the other an idler.

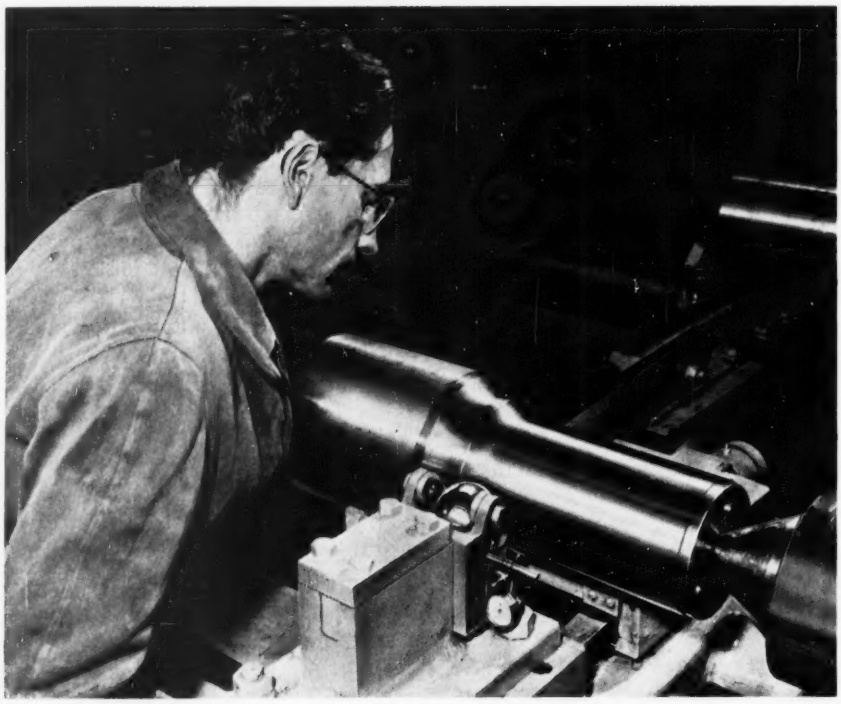


Fig. 11. Turning and grinding marks are removed and physical properties of journals are improved in this burnishing operation. Both ends are burnished at one time.

overhead monorail transfers the completed axles to an assembly table. Adjacent to this table are four Betts vertical boring mills, such as the one seen in Fig. 12. On each machine, a car wheel is both rough- and finish-bored, maintaining size to fit a particular axle, in one downward stroke of the Davis boring-bar.

A beam which pivots on a post at the side of the boring mill facilitates loading and unloading. The wheel is mechanically clamped in a four-jaw chuck on the rotating table of the machine. During rough-boring, the work is rotated at 94 R.P.M., and two carbide-tipped tools are fed hydraulically through the 8 1/4-inch diameter bore at the rate of 4 3/4 inches per minute. When the roughing tools clear the work, the boring-bar is rapidly traversed to bring the two high-speed steel finishing tools to the wheel. The work speed is reduced to 23 1/2 R.P.M., and the finishing tools are fed at the rate of 3 1/2 inches per minute. From 3/16 to 1/4 inch of stock is removed per side during rough-boring, and about 0.020 inch in finish-boring. Work speeds and feed rates are

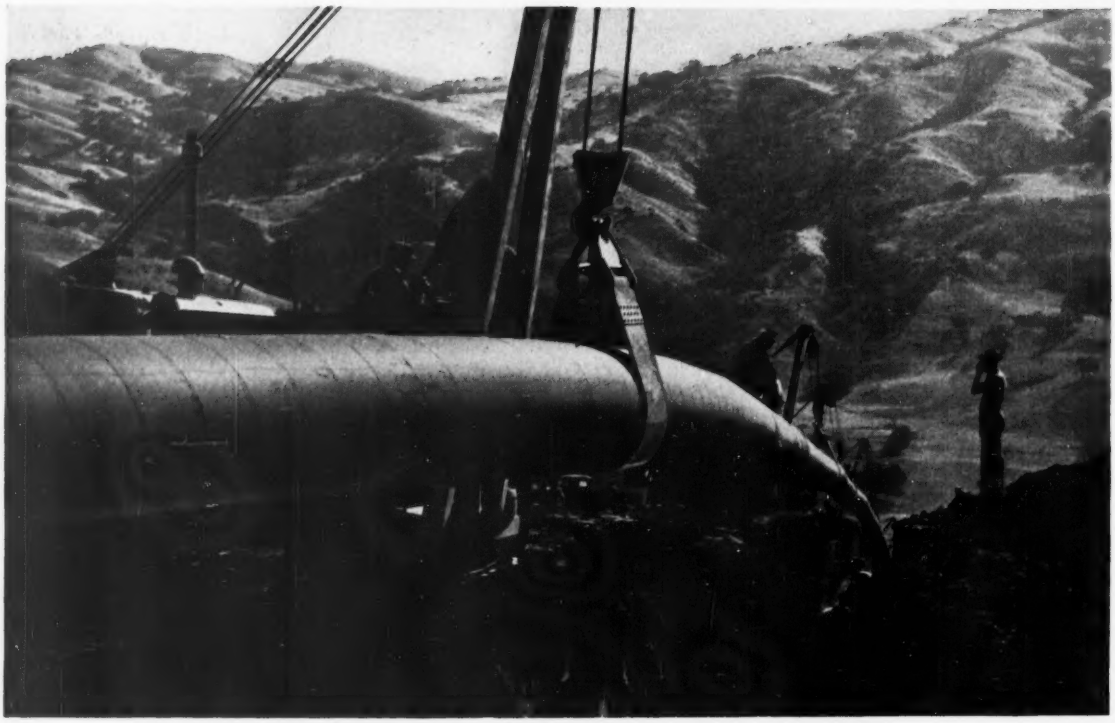
Fig. 12. Car wheel is both rough- and finish-bored to fit a particular axle on this machine. From 3/16 to 1/4 inch of stock is removed per side.

Fig. 13. Hydraulic presses are used to insert two tapered cups and seal ring in each journal box prior to fitting tapered cone and roller assemblies.

automatically changed during the machining cycle of the equipment.

Special protectors are placed over the journals, and the bored wheels are pressed on the completed axles. Journal boxes, which hold the Timken tapered roller bearings currently being applied to freight car axles, are thoroughly cleaned before assembly. Hydraulic presses, Fig. 13, are employed to insert two tapered cups and the seal ring for the bearings in each journal box. Tapered cone and roller assemblies are then fitted in the journal box, and the latter is mounted on the starting sleeve placed at the end of the axle.

Assembled journal boxes are hydraulically pressed on both ends of the axle simultaneously. End cap-bolts of the journal box are tightened in the tapped holes of the axle with a torque wrench. After inserting a carefully controlled amount of grease in the journal boxes with a pneumatic pump, the anti-friction axles are ready to be assembled to freight cars, or stored, as seen in the heading illustration, available for service when required.



Fabricating Pipe for the "Super Inch" Gas Line

By Gordon B. Ashmead

PIPE for the expansion of the "Super Inch" gas line is being made in the heart of the California region it serves. Already possessing the distinction of being the country's largest-diameter high-pressure line, the addition of new relays and parallel lines will raise the incoming capacity of the "Super Inch" from 400,000,000 to 700,000,000 cubic feet daily. Completion of the various projects involved is scheduled for sometime in 1954.

Both the South San Francisco and Maywood, Calif., plants of the United States Steel Corporation's Consolidated Western Steel Division are fabricating the 34-inch manganese steel pipe. The straight-through production line operation at South San Francisco, featured in this article, is an improved version of the original line developed at Maywood to make pipe for the "Big Inch," which first brought Texas gas to metropolitan Los Angeles. The pipe is being made for the Pacific Gas & Electric Co.

Plate stock is introduced at one end of the production line, and high-strength pipe is finished, inspected, and loaded on flat cars at the other end of the line. At no point is the line more than 75 feet wide. There is no backtracking of the pipe during processing—all movement is forward. In addition, the line is entirely mechanized from start to finish.

Initially, the stock, about 1/2 inch thick, 104 inches wide, and 32 1/2 feet long, is trundled on powered rollers to the first of two Baldwin-Southwark giant plate planers. These machines automatically locate the plate, hydraulically clamp it in position, and then plane one of the long edges, truing and beveling it for welding.

This operation is shown in Fig. 1. In the foreground can be seen the huge screw by which the traverse carriage draws the cutting tools along the edge of the plate. After a conveyor slides the plate some 30 feet forward to the companion planer, it is again located and clamped, and the

Fig. 1. One of the two plate planers that true and bevel the long edges of the plate before welding the pipe seam.

other long edge is finished, this time also reducing the plate to the required width.

From this second planer the plate advances to edge formers, Fig. 2, which bend an area a few inches wide at both long edges to the radius of the finished pipe. This step facilitates the work of the pyramid rolls, Fig. 3, in converting the plate to pipe. This is a two-stage forming operation, the seam edges of the pipe usually being aligned in two passes through the rolls.

Upon leaving the rolls, the pipe is conveyed to the fixture shown in Fig. 4, where the outside of the seam is welded in a submerged arc. The fixture aligns the abutting edges of the pipe, holding them together as the pipe progresses past the welding station seen at center. A back-up bar in the pipe directly beneath the joint is water-cooled to avoid burn-through during the welding operation.

There are two welding heads, arranged in tandem. One head is served by alternating current, the other by direct current. Flux in granu-

Fig. 2. These formers bend the first few inches near the plate edges to the radius of the finished pipe.

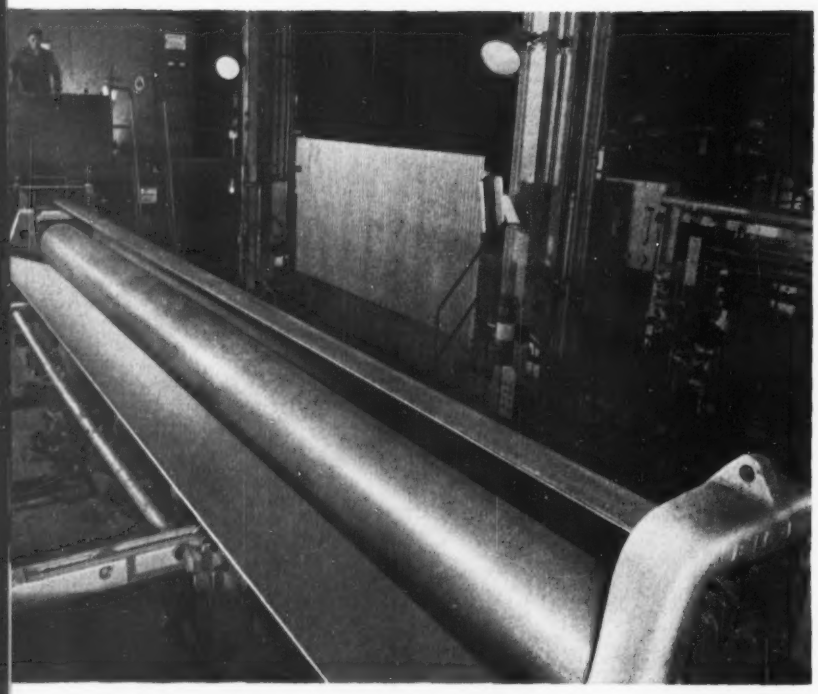


Fig. 3. Two passes through these pyramid rolls are usually sufficient to convert the plate to pipe.

lar form flows down a hose from a hopper, visible above the seam. (The view shows the pipe emerging from the finish end of the welding machine.) While the flux covers the weld area, excluding air, the molten electrodes and parent metal fuse together. Immediately beyond the welding location, the spent flux is broken off the pipe, then removed by vacuum. This machine welds all but the first and last 6 inches of the pipe length.

For welding the inside of the seam, the pipe is moved to another station and rotated 180 degrees to permit a boom type machine, Fig. 5, to operate in a down position. This welder also has a tandem submerged arc.

The ends of the seam are finished on a semi-automatic squirt type welder. In appearance, this machine resembles a large funnel, with the electrode, or welding wire, extending from its small end. After cleaning the ends of the pipe, the operator energizes the machine, causing flux to flow from the funnel and cover the welding wire.

Both outside and inside seams are ground smooth, then inspected visually. For this, the worker pushes himself through the pipe on a dolly, as seen in Fig. 6. Subsequently, the pipe is subjected to a "Dy-Chek" for minute surface flaws and cracks. This process consists of painting a bright red dye of high capillarity on the surface of the pipe. After drying, the dye is wiped off, and a white developing powder is sprinkled over the work. The dye trapped in any irregularities in the surface is drawn out by the powder, making them immediately apparent.

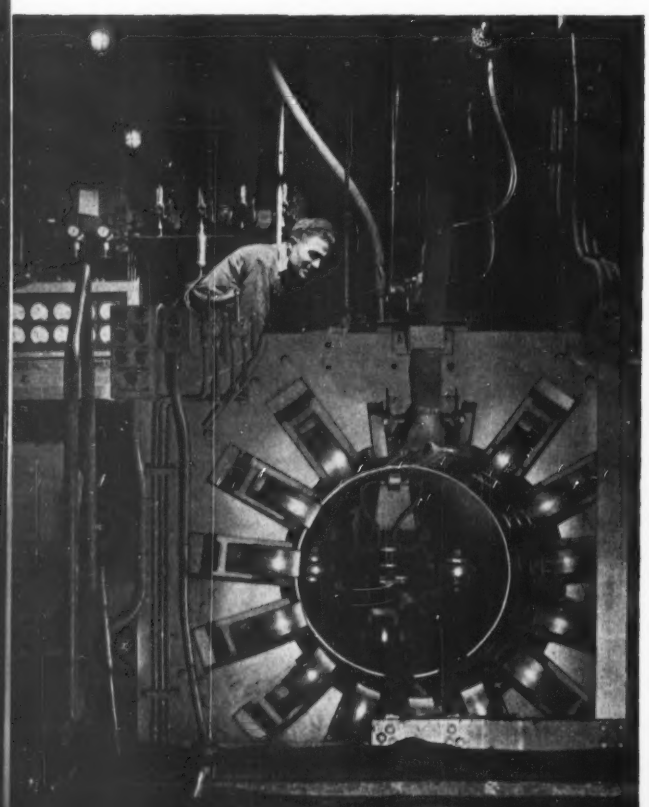


Fig. 4. For welding the outside of the seam, the fixture holds the abutting edges in alignment as the pipe progresses through the welding station.

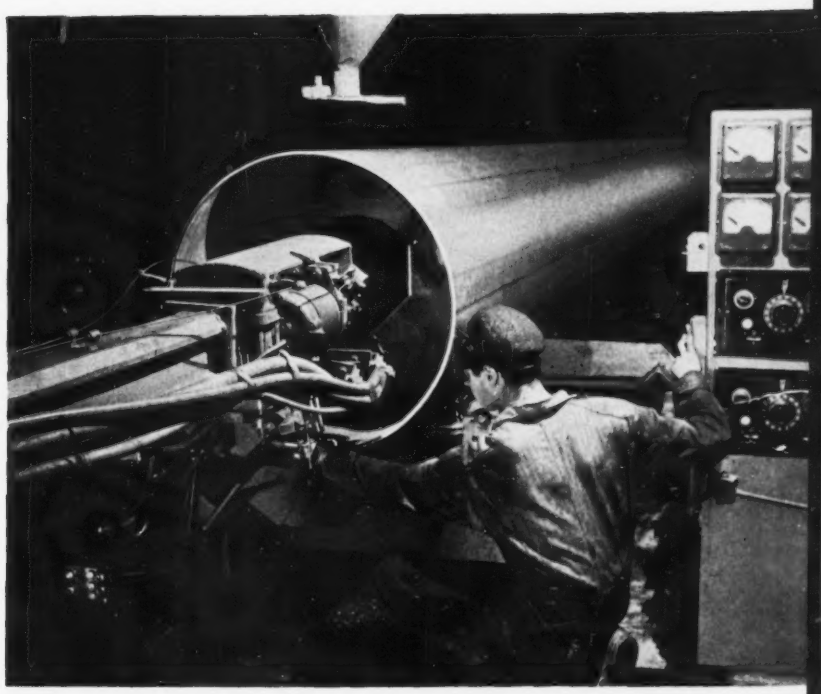


Fig. 5. A tandem submerged-arc welding set-up is also employed for the inside of the seam.

Any defects disclosed are rectified at this point.

Following inspection, the diameter of the pipe is expanded in order to increase its yield strength from 45,000 to 58,000 pounds per square inch. First, each end of the pipe for a distance of 3 inches is expanded hydraulically to the required 34-inch diameter. This step is done preparatory to expanding the full length of the pipe, since it is not possible to hold the ends water-tight and expand them at the same time.

With the ends completed, the pipe is shunted to an expanding machine where it passes through a spray wash of soluble oil and water. Water-tight head seals next close over the ends, and hinged dies close around the pipe, forming a restraining jacket in which the pipe can bulge slightly. The drawing, Fig. 7, illustrates the principle of the expanding machine.

When the ends are sealed and the dies are closed, water is introduced into the pipe at pressures from 1700 to 2100 pounds per square inch (depending on wall thickness), bulging the pipe to the inside walls of the dies. A view of the machine after the water is released and the dies are opened is shown in Fig. 8. The pipe is then tested hydrostatically, the pressures used being somewhat less than those in expanding. While still under pressure, the pipe is hammer-tested and closely examined for leaks. It is then ready for final processing.

An advantage of this type of expanded pipe is that cold-working makes it possible to use thinner plate stock—substantially reducing the cost of a pipe line two hundred or more miles long. Furthermore, since the expanding is done

Fig. 6. Using a flashlight, the operator inspects the inside of the seam as he pushes himself through the pipe on a dolly.

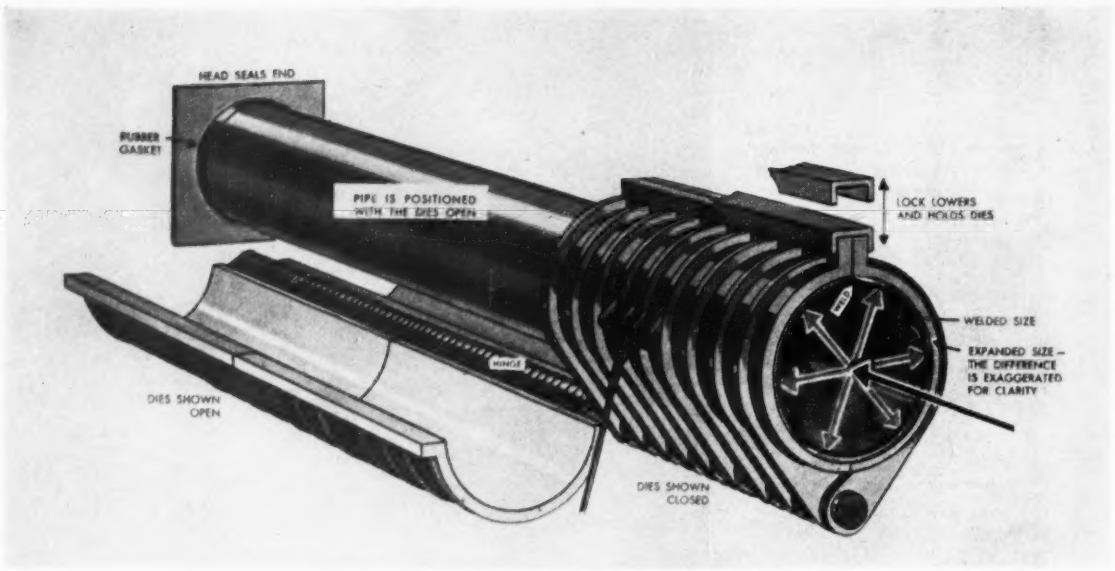

HEAD SEALS END
RUBBER GASKET
PIPE IS POSITIONED WITH THE DIES OPEN
LOCK LOWERS AND HOLDS DIES
WELDED SIZE
EXPANDED SIZE — THE DIFFERENCE IS EXAGGERATED FOR CLARITY
DIES SHOWN OPEN
DIES SHOWN CLOSED

Fig. 7. The drawing illustrates the open and closed positions of the hinged dies employed in the expanding machine.

in perfectly aligned dies, the finished pipe length is straight and round. Actual expansion of the material in a 34-inch finished pipe averages 1/2 inch in diameter. There is an attendant small shrinkage, about 2 1/2 inches, in the length of the pipe.

Before pipe sections can be welded together, the ends are squared and beveled on a giant end-facer. This is a special lathe that has two cutter-heads. Set in the end-facer, the pipe is revolved, with an operator at each end controlling a cutter-head. An integral gage measures the pipe length.

To reduce the amount of welding that must be done in the field, two sections are welded together in the shop, producing a joined section more than 60 feet long. A special submerged-arc welding machine aligns the single lengths, holding them the correct distance apart at the joint.

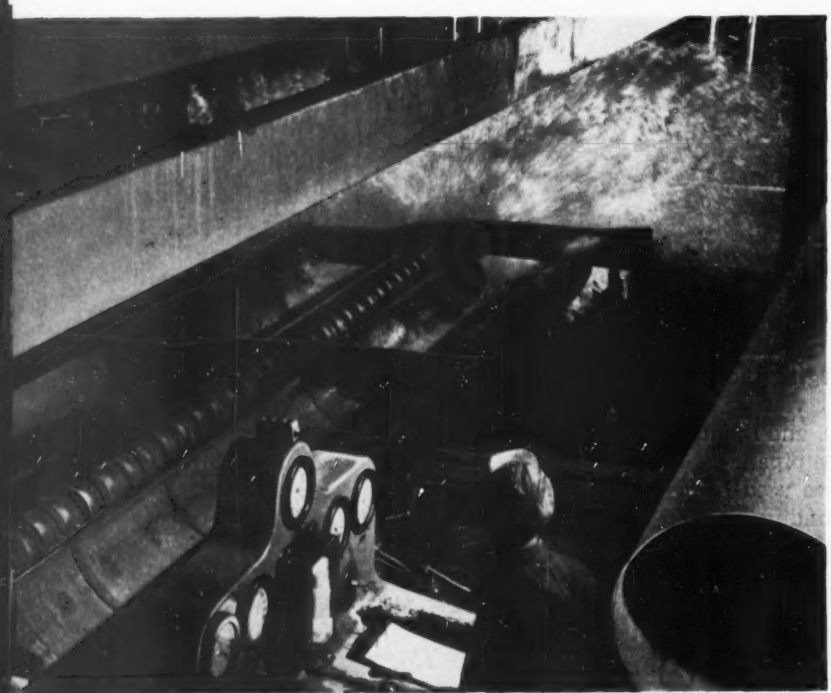


Fig. 8. Following the release of the water after the expanding cycle, the pipe undergoes a hydrostatic test.

Lubricants Aid Abrasive-Belt Grinding and Polishing

By Jack Durnan
Products Engineering Department
Behr-Manning Corporation, Troy, N. Y.

THE abrasive-coated belt long ago found acceptance as an important grinding and polishing medium. Now, with the relatively new widespread practice of running the belt wet, some pointers are in order regarding the selection and use of lubricants.

Primarily, lubricants are used on abrasive-coated belts to maintain cool cutting, improve finish, and increase belt life. Best results can be obtained only through the proper choice of lubricant for the particular grinding or polishing job. The choice, in turn, is governed by the specific purpose of the grinding or polishing, and by the material to be ground.

Where removal of stock is the primary objective, the main function of the lubricant is to dissipate heat and wash away the ground-off particles to prevent rapid loading of the belt. But if polishing is the primary objective, a lubricant is needed to cushion the cutting action of the abrasive grains of the belt, and to prevent them from penetrating the work too deeply.

This cushioning action is responsible for probably one of the least-recognized economic advantages of wet over dry grinding where the operation is performed preparatory to buffing. The finer finish obtained by wet grinding makes it possible to greatly decrease the buffing time required to put a high polish on a part. Less buffing compound is required, and wear on the buffing wheel is greatly reduced.

The nature of the material to be ground affects lubricant requirements. In general, a hard material, such as steel, requires a lubricant that will keep the work cool. In grinding a soft material, such as aluminum, a lubricant is required that will prevent the belt from loading with the grinding particles.

Water, soluble-oil mixtures, sulphurized cutting oil, and grease have been used for many years in other grinding mediums. With certain modifications necessary to insure successful performance, these lubricants also are employed in abrasive-coated belt grinding. For instance, abrasive-coated belts take greases with lower melting points than are used on set-up wheels. (These are polishing wheels coated with glue and rolled in abrasive grains.)

To meet all grinding and polishing needs, and to take advantage of the benefits available with abrasive-coated belts, greases with low melting points over a range of viscosities had to be compounded. The reason for this is the fact that abrasive grains of the belt are not buried in the bonding agent that holds them to the flexible backing as in a grinding or set-up wheel, but are half-exposed above the backing and the adhesive

Fig. 1. Water serves as an ideal coolant for grinding the edges of a window. Since no costly equipment is involved, rust prevention is not a factor.

coats. The spaces between the grains permit a free flow of lubricant through the grinding area and serve to keep the belt cool.

Any one of these lubricants will fill the requirements of most belt-grinding jobs. Their application will now be considered.

Ordinary water is used as a lubricant on abrasive-coated belts in grinding glass, thermoplastics, and ceramic objects. In Fig. 1, for example, is shown the operation of "seaming" the edges of a car window. The belt runs through a tank of water, serving to keep the glass cool and flushing away the ground off particles.

Water will carry away more heat per volume than any commercially available coolant, and it is highly effective in preventing the part from overheating in the grinding area. If permitted to build up, high temperatures will melt thermoplastics and produce excessive stresses in glass and ceramic objects, ultimately causing cracking and breakage.

To take full advantage of the high rate of stock removal made possible by the use of abrasive-coated belts, the work or belt should be flooded with water in order to dissipate as much heat as possible. In most instances, the water is not recovered. Although water as a coolant is unexcelled, the danger of rust to finished surfaces of machines limits its use.

Where filtering and recirculating equipment is provided, a soluble oil is added to the water. In small amounts, the oil not only retards rust but is also instrumental in producing a better finish than is possible in grinding dry or with plain water.

A soluble-oil mixture is highly effective in grinding materials such as aluminum, if stock removal is the primary objective. The water frees the belt of particles, and the oil prevents rust from forming on exposed machine parts. Typical of such operations is the grinding of die-cast aluminum saw housings on the Porter-Cable machine in Fig. 2. The integral coolant system of the machine keeps a copious flow of the mixture on the belt.

If a lubricant is not used in grinding aluminum, even a coarse-grit belt tends to load to some extent, and cutting action is retarded. With belts of medium or fine grit, this loading takes place almost immediately; often belt life may be measured in minutes, even seconds, where aluminum is ground dry.

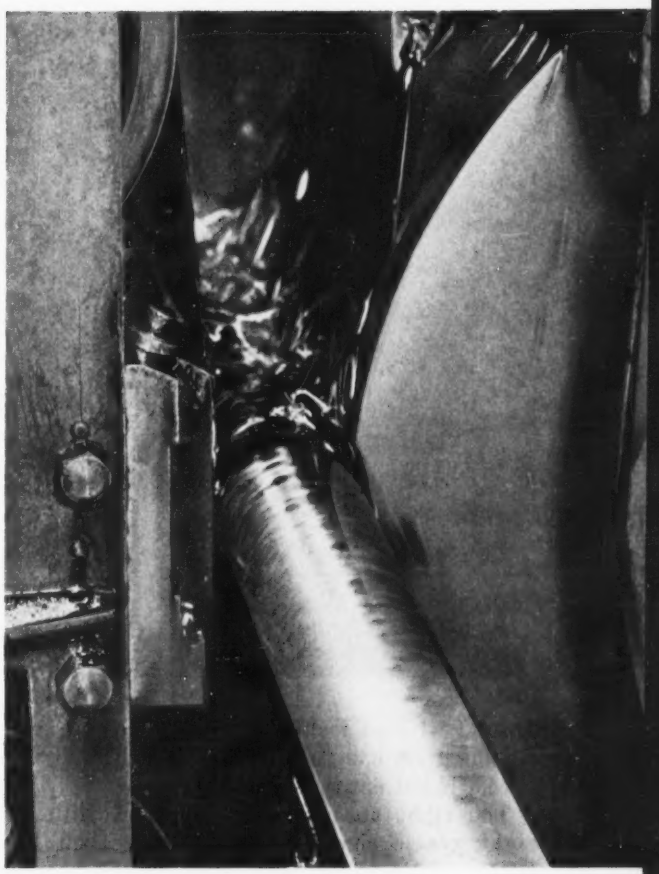
The value of using a lubricant with coated abrasives was demonstrated in one case in which a manufacturer of locomotives had the problem of grinding large aluminum housings. The operation was being performed with a dry belt on a large platen type grinding machine. Production was at the rate of three parts per hour and eight parts per belt. In a laboratory test using the same type of machine but flooding the belt with a soluble-oil lubricant, twenty-five pieces were ground in only thirty-seven minutes with little evidence of belt wear. Needless to say, the manufacturer converted immediately to wet grinding.

What is true in grinding aluminum also holds true in grinding materials such as soft brass, white metal, zinc, and other non-ferrous metals. All such materials must be ground with a lubricated belt, and if stock removal is the primary objective of the operation, a soluble-oil lubricant should be used.

As stated, the addition of soluble oil to water not only retards the formation of rust but also improves the quality of finish on the ground part. Up to a certain point, the finish improves as the oil-to-water proportion is increased, because of the superior cushioning action obtained. The lubricant fills the cavities between the coated abrasive grains on the belt and resists the penetration by the grains of the part being ground.

Fig. 2. The soluble-oil mixture retains the coolant properties of plain water, protects costly equipment, and improves the work finish.

Fig. 3. Cutting oil is employed on this centerless belt-grinding machine, where high grinding pressures are developed.



In mixing soluble oils with water, the directions of the supplier should be adhered to. An oil recommended for soft water may be totally unsatisfactory for hard water. No single grade or mixture serves all purposes.

When production requirements indicate heavy grinding pressures, the use of sulphurized cutting oil should be considered, because of the likelihood that particles of the work will otherwise weld to the abrasive grains. This type of oil should also be considered where a substantial amount of non-ferrous metal is to be removed by abrasive-belt grinding.

The advantages offered by cutting oils have been exceptionally noteworthy on centerless abrasive-belt grinding machines. In Fig. 3 is shown a typical centerless grinding operation. Here, cutting oil makes possible a stock removal rate of 1 pound per minute on a grinder made by the Production Machine Co.

New equipment designed to use cutting oils has improved belt life over old equipment on which belts were run dry or with a soluble-oil mixture. One test disclosed that in a given period the weight of stock removed in a centerless grinding operation on AISI 316 stainless-steel tubing increased from 13 ounces to 38 pounds, simply by the substitution of cutting oil for a soluble-oil mixture. Subsequent tests, after further refinements in abrasive materials and grinding techniques, have almost doubled this already astronomical increase. Better production and belt life have also been experienced in other types of equipment by adapting them for the use of sulphurized cutting oil.

Of significance today is the tremendously important part that cutting oil is playing in the manufacture of turbine components for jet aircraft. Blades, buckets, and nozzle diaphragms are being ground and polished by the thousands on machines using cutting-oil lubricated abrasive-coated belts.

It is not possible, however, to make a blanket substitution of cutting oil for soluble oil. The sulphur in the cutting oil reacts chemically with bronze or brass parts, causing discoloration that is often objectionable. In addition, an adequate exhaust system is needed to remove the smoke and fumes generated by the oil.

Grease sticks are used for off-hand grinding and polishing operations to lubricate belts where the flow of a liquid is impractical. A low melting point grease is required to obtain a uniform surface over the face of the belt. The grease should flow at approximately 100 degrees F. without being thrown off by centrifugal force when the belt runs around the driving and idler wheels.

If finish is important, a heavy-bodied grease should be selected, in order to form a film that will cushion the cut and retard the full penetration of the part being polished by the exposed area of the abrasive grain. Where stock removal is the primary objective, it is important to keep the belt from loading but at the same time retain fast cutting action. In this instance, a light-bodied grease should be used.

Sometimes, as in Fig. 4, a single belt is used for both stock removal and polishing by lubricating it with greases of two different weights. In the illustration, one half of the belt is coated with light grease to prevent loading during stock removal, and the other half is coated with heavy grease for the polishing operation.

The surfaces of thin, small parts when ground dry will frequently tend to burn if high pressures are exerted or high belt speeds are maintained. An application of the correct grade of grease to the belt will overcome this condition. Some thermoplastics, generally ground with water as a lubricant, are also being successfully

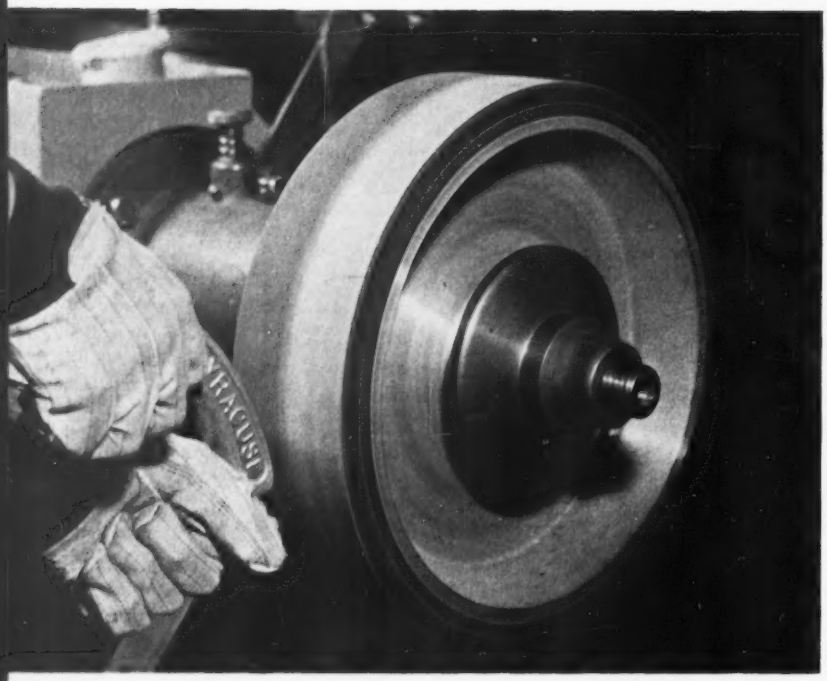


Fig. 4. Time is saved by grinding and polishing the work with the same belt.

ground without melting on grease-coated belts. Buffing time has usually been substantially reduced, if not entirely eliminated.

The right abrasive belt combined with the right grease should produce a long belt life. Often a belt will be discarded simply because the abrasive surface has become loaded with small particles of the work. This condition can, no doubt, be avoided by selecting the correct grade of grease and applying it so as to leave a uniform and wet surface on the belt. Periodic applications of the grease are required. An experienced operator can readily determine the frequency of application.

Even with grease, the belt eventually loses some of its effectiveness. A light application of kerosene cuts the grease, and the belt will then automatically free itself of the embedded particles. Regular degreasing units are often used to prolong belt life.

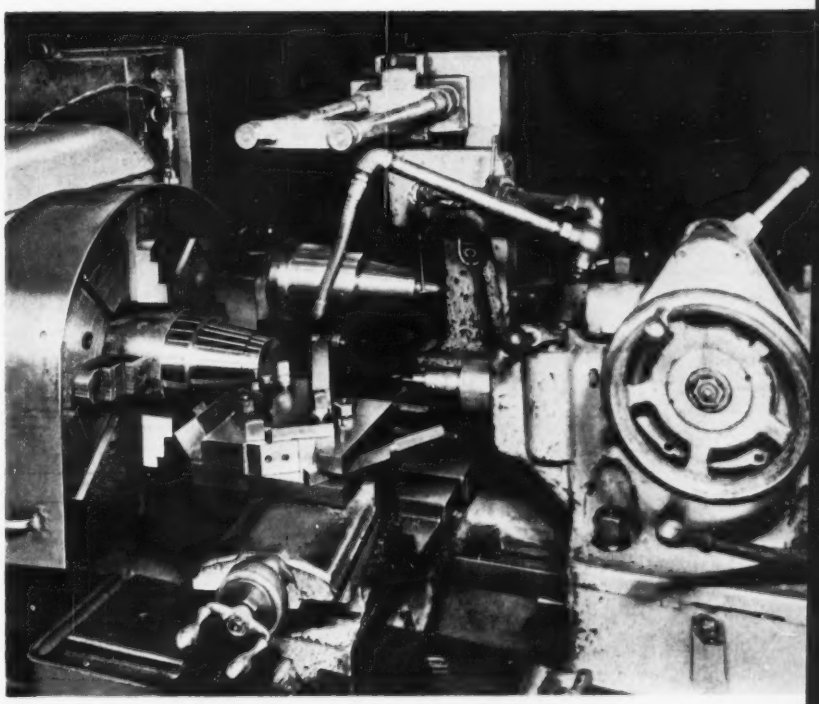
Machining Hardened Tool Steel with Tungsten Carbide

CONSIDERABLE success has been experienced at the Allentown, Pa., plant of the Western Electric Co., in using tungsten-carbide tools to machine hardened tool steel. In one application, after a steel punch having a hardness of between 60 and 63 Rockwell C had chipped due to accidental damage, the tool-room found it possible to use a standard carbide-tipped tool to machine a bead on the face of the punch. After machining, the punch was stoned and polished, and restored to use in a fraction of the time normally required to make a new punch.

In another instance, the supply of a certain high-speed steel trepanning cutter was exhausted due to delayed delivery. There were, however, other trepanning cutters of larger size which could be substituted if they were machined to size. Here again the tool-room machined hardened tool steel (60 to 63 Rockwell C) with carbide cutters.

For machining the trepanning cutters, a lathe was operated at about 120 R.P.M. (15 feet per minute), with a feed of 0.0025 inch per revolution and a depth of cut of approximately 0.020 inch. A minimum of material was allowed to remain for final grinding. All cutting was performed dry, and the tool was resharpened after each cut. This application of tungsten carbide proved opportune in eliminating the delay of waiting for a new cutter.

Chasing Tapered Threads Up to a Square Shoulder



SPECIAL tooling was devised by engineers at the Evansville, Ind., plant of the Bucyrus-Erie Co. to solve the problem of chasing threads right up to a 90-degree shoulder. The threads are produced on the tapered ends of oil-well drilling bits, 9 inches in diameter by 5 feet 2 inches long, and weighing 500 pounds each.

Threading is performed on the Lodge & Shipley 25-inch, hollow-spindle Copymatic lathe seen in Fig. 1. Both finish-contour-turning and thread chasing are completed in the one set-up, with carbide-tipped tools held on the specially designed tool-block shown diagrammatically in Fig. 2.

After contour-turning, spring-loaded chasing tool *A* is cocked into cutting position by means of a lever *B* that pivots about pin *C*. As the chasing tool reaches the end of the tapered thread, an adjustable trigger *D* contacts shoulder *E* on the work-piece, causing tool-block *F* to pivot clockwise about pin *G*. In pivoting, latch mechanism *H* releases the chasing tool holder *J*, allowing the holder and tool to be retracted by the action of the springs. Thus, the tool is cleared and danger of tool damage against the shoulder eliminated.

Single-point, carbide-tipped forming and chasing tools are employed, with a cutting speed of approximately 250 surface feet per minute. This combination of a hollow-spindle Copymatic lathe and special tooling has solved the problem of threading to a square shoulder. Also, considerable machine time has been saved, production increased, and closer tolerances maintained.

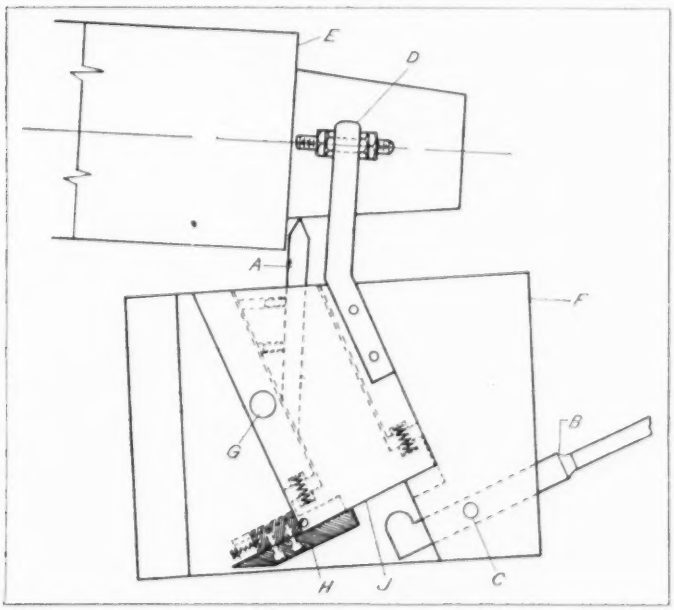


Fig. 1. (Above) Hollow-spindle Copymatic lathe is employed for both finish-contour-turning and thread chasing.

Fig. 2. (Left) Drawing of special tool-block that permits chasing tapered threads up to a 90-degree shoulder

Spherical Surfaces Produced with New Boring Mill Bar

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and
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A NEW boring-bar for horizontal boring, drilling, and milling machines provides a means of cutting spherical surfaces. Introduced by the Davis Boring Tool Division of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., the bar is currently being used for machining the bearing seats of pedestals and caps in the Large Motor and Generator Department of the General Electric Co., Schenectady, N. Y. The device has been successful in reducing floor-to-floor time, in maintaining close tolerances, and in producing a better finish than was previously possible.

The principle embodied in the design of the bar consists of feeding a revolving cutter in an arc, the center and radius of which coincide with that of the desired spherical surface. In Fig. 1, a close-up view taken from the rear of the machine, can be seen the general construction of the bar. The work *A*, one of the pedestals, has a central rib *B* which forms the lower half of the bearing seat. A cap, also provided with a central rib to form the upper half of the seat, has been removed to expose the bar. During the actual machining, the cap is doweled and bolted to the pedestal. The view from the

Fig. 1. The machine table is adjusted so that pin (J) is over center of desired spherical surface.

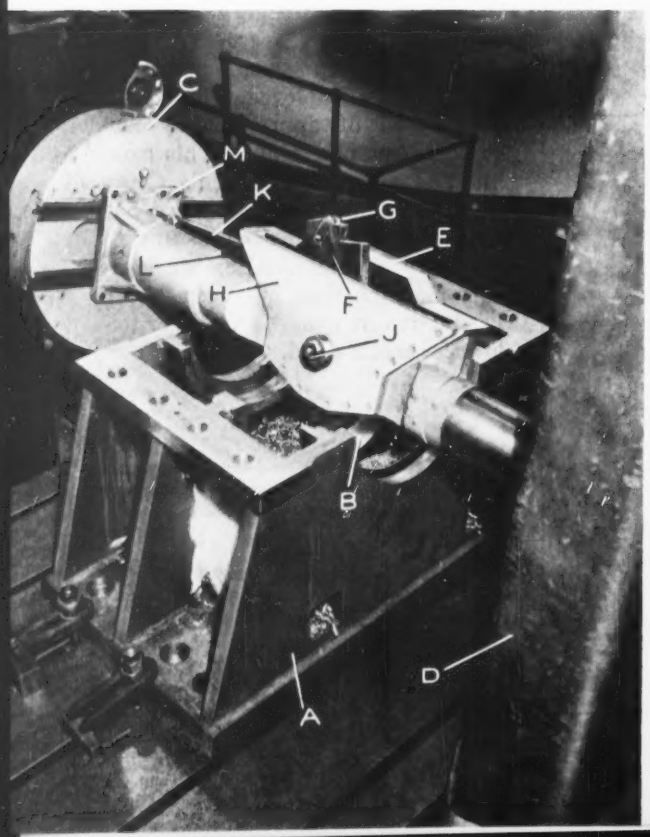
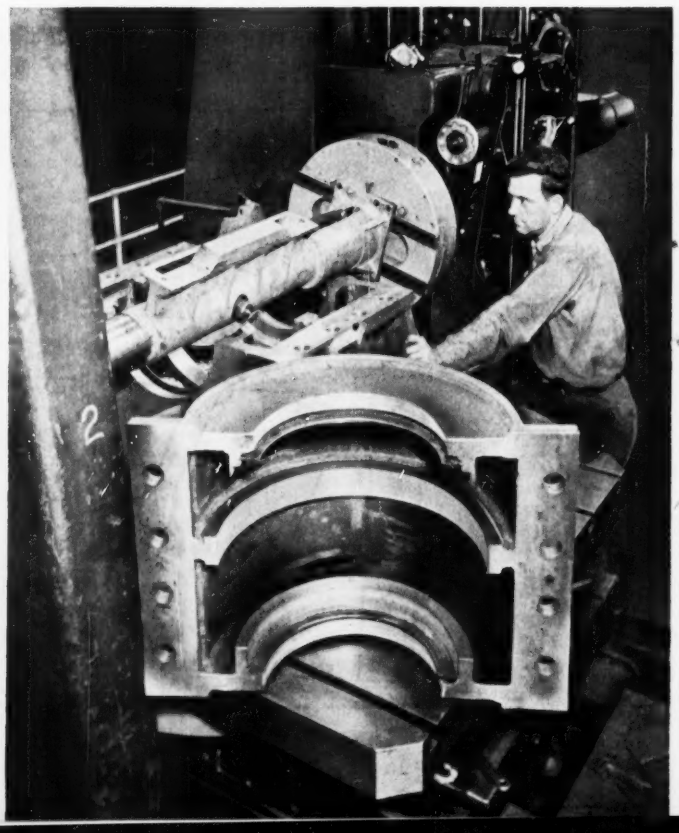


Fig. 2. During machining, the cap in the foreground is doweled and bolted to the pedestal.



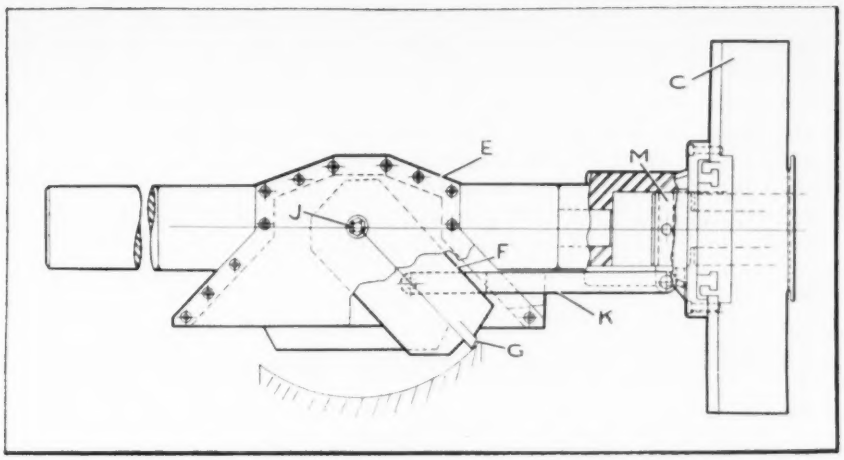


Fig. 3. As the spindle advances in a straight line, the cutter-block feeds in an arc.

front of the machine, Fig. 2, shows the cap in the foreground.

One end of the bar is flanged, and bolted to the body of the facing head *C;* the other end is turned cylindrically, and bears in the end support *D* of the machine. At its center, the bar has the shape of a shelf *E* for a cutter-block *F* containing a carbide-tipped insert *G*. A keeper plate *H* retains the block against the shelf, and a pin *J* through the center line of the bar engages a hole in the enclosed end of the cutter-block.

The location of the shelf relative to the axis of the bar is such as to support the cutting edge of the insert on a radial line. Also, the distance from the tip of the insert to the center of the pin is equal to the radius of the desired spherical surface.

To feed the cutter-block in its arc, a link *K* connects the block with the spindle of the machine. Since both the facing head and the flanged end of the bar are hollow, the spindle is able to advance through them. The link is accommodated in a channel *L* in the bar and runs through the side of the shelf to the cutter-block, to which it is hinged. The other end of the link is hinged to a cross-piece *M* fixed in a drilled hole in the spindle. Feeding is con-

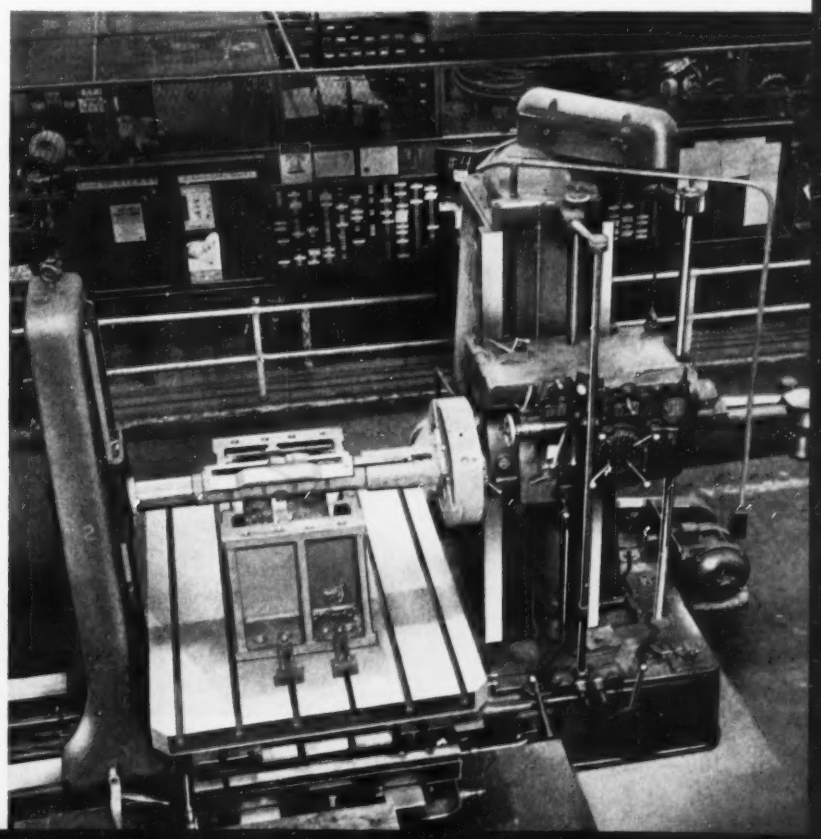


Fig. 4. The new bar makes it possible to retain the original set-up of the work for spherical machining.

tinuous, since it is timed to the rotation of the spindle.

A diagram of the bar (not drawn to scale) is shown in Fig. 3, the various parts being designated with the same references as in Fig. 1. Different diameters of bearing seats can be produced with the same bar by substituting other cutter-blocks of appropriate length.

It will be noted from Fig. 4 that the pedestal is supported on a turntable. The purpose of this arrangement is to permit the spherical surfaces of the pedestal and cap to be completed from the same work set-up used for boring, grooving, and facing the end ribs. For these preliminary operations, a stub boring-bar is mounted on the facing head, and after one end is completed individually, the turntable is rotated 180 degrees.

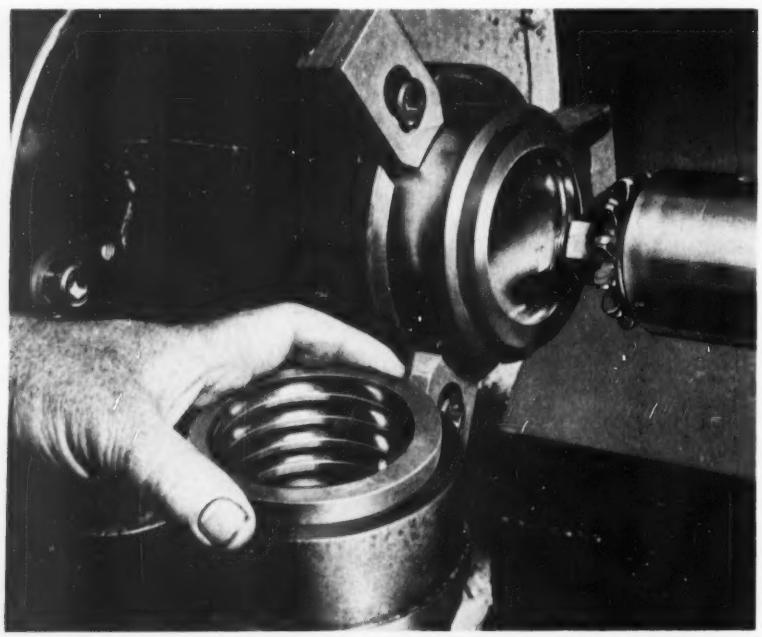
Thread Milling Production Boosted by Carbide Cutters

THREAD milling of ball raceways in actuating nuts is being handled efficiently and economically with tungsten-carbide-tipped cutters at the plant of Vard, Inc., Pasadena, Calif. A typical operation is on an S A E 8620 steel, main-gear actuating ball nut shown in the illustration, in which the major diameter of the raceway is 3.062 inches. A total of 16 3/4 turns, or threads, are milled in the raceway with the work-piece rotating counter-clockwise at 18 R.P.M. and the cutter counter-clockwise at 328 R.P.M. Depth of cut is 0.100 inch and chip load per tooth is 0.0045 inch. Approximately 0.007 inch of stock is left for finish-grinding.

The cutter employed for this operation is 2.500 inches in diameter and has twelve teeth with a 0.153- to 0.154-inch radius, 3-degree negative radial rake, and 0-degree axial rake. Various grades of tungsten carbide first used in this cutter gave only two or three pieces per grind. Now, tipped with Kennametal K4H, nine pieces are easily machined between grinds.

A 5-degree positive axial rake on alternate teeth was tried. However, since this design change increased grinding costs without improving finish or cutter life, it was dropped in favor of the O-degree axial rake. Accurate cutter regrinding is essential to maintain cutter life.

Machining is done on a Shields thread mill that has been modified by adding a 100-pound flywheel on one end of the quill through which the coolant is piped directly to the cutter. A combination faceplate and pot chuck is used for holding the work-piece. The machine was overhauled to minimize backlash and bearing play, and a 5-H.P. motor installed.



The tungsten-carbide-tipped cutter here illustrated has increased production in thread milling of ball raceways in actuating nuts.

How Position Tolerances Affect Gaging Requirements

Part I

Tolerances are established to control variations in size, form, position, and function. In this ninth of a series of articles on dimensions and tolerances for mass production, the author shows how tolerances on position are selected and how they determine the gaging requirements

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CONDITIONS of position, when properly specified, should provide an accurate means of defining such features as the location of a group of holes, the alignment of several cylindrical surfaces on a shaft, the squareness of faces with other faces or with the axis of rotation, and so on. As is the case with other types of dimensional specifications, a tolerance is usually required for a dimension relating to a condition of position. Unfortunately, at present no generally accepted practice exists for expressing such tolerances and the use of the various co-existing practices often leads to misinterpretation of certain position tolerances in relation to the inspection gages which these tolerances represent.

Tolerances are omitted entirely on most conditions of position, not because they are not needed but because the use of present conventional methods of expressing them leads to redundant tolerance conditions which are difficult or impossible to reproduce in the form of definite inspection gages. In other words, conventional methods of expressing tolerances fail to meet the needs of tolerances on many conditions of position. In practice, jigs and other workholding devices for mating components are matched with each other and adjusted or corrected as necessary, so that interchangeable assembly is secured—at least for any single manufacturing plant—and the problem of precise dimensional specifications for many conditions of position is side-stepped entirely.

Expressing Positional Tolerances

S A E Recommended Practice—The S A E Automotive Drafting Standards recommend the use of a note to specify the permitted variation in position of a group of holes. The application of this proposal is shown in Fig. 1 for a group of six bolt holes in a flange. Bolts 1/2 inch in diameter are assembled in these holes and an allowance of 0.015 inch has been applied to the basic size of the hole. This is a case where the shaft basis is used for the allowance. The note that expresses the positional tolerance reads:

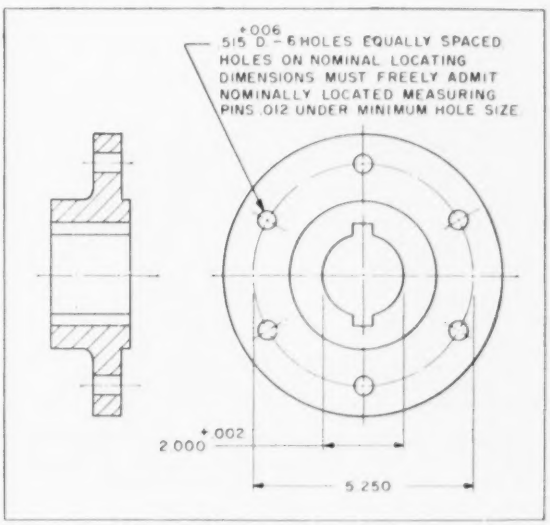


Fig. 1. In addition to the note regarding the position of the group of holes, additional specifications concerning concentricity of the bolt circle with the flange and the position of the keyway relative to the bore of the flange are needed to complete the positional specifications.

HOLES ON NOMINAL LOCATING DIMENSIONS MUST FREELY ADMIT NOMINALLY LOCATED GAGE PINS 0.012" UNDER MINIMUM HOLE SIZE. In effect, this note defines the inspection gage.

This new S A E standard represents a step in the right direction, but it does not go far enough. A condition of position implies some bench mark or datum—position from what or where? This datum must be some definite surface from which the position is measured. Nothing in the S A E proposal covers this important factor. Again, on some components, there are several different groups of positional conditions, and often they must be related to different datums. In the example in Fig. 1, part of the condition of position of this group of bolt holes is the degree of concentricity of the bolt circle with the centering feature of the flange. Again, nothing in the Standard covers the conditions of symmetry.

British Proposal for Positional Symbols—A special committee of the British Armed Services (set up by the British Admiralty with the task of proposing a code of standard drawing office practice and guiding instructions relating to the application of tolerances to designs for interchangeable manufacture) has proposed for this purpose the use of an ingenious and effective symbol system which is well worth serious consideration and general adoption, at least as a big step toward a more nearly complete system of dimensional specifications with tolerances. There is always opposition to the adoption of new symbols, but adequate notes for the same purpose take up too much space on the detail drawings. In the final analysis, drawing practice is an arbitrary symbolic language where every effort is made to express technical information as concisely as possible.

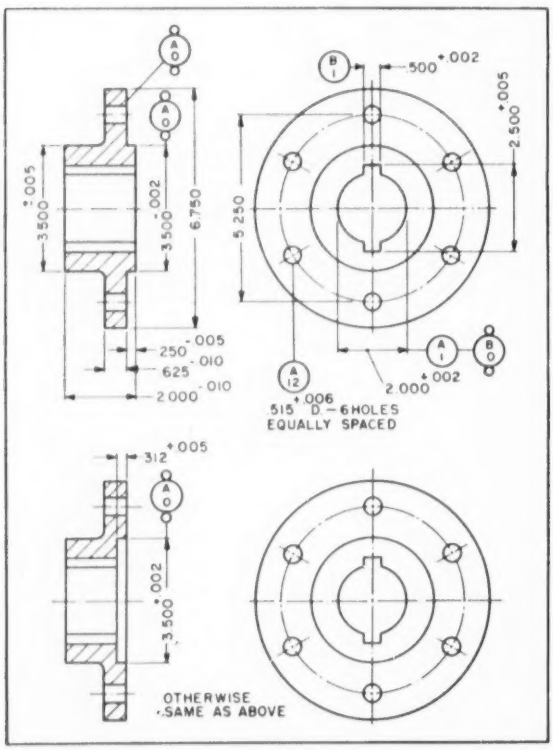


Fig. 2. The symbols contained in the small circles show positional tolerances, and also group together (by means of letters such as *A*, *B*, and *C*) those positional conditions having a common functional purpose and datum.

For one thing, the proposed positional symbol groups together the several positional conditions that have a common functional purpose into specific functional trains of dimensions, all having the same registering surfaces or datums, and it marks them with a common letter such as *A*, *B*, *C*, and so on. This practice forces the designer or draftsman to study the functional requirements of the part thoroughly before these positional dimensions are assigned, and this in itself is well worthwhile.

The positional letter symbol on the drawing is contained in a small circle with a figure below it which represents the tolerance, in units of 0.001 inch, or the total variation or run-out of the position from that defined by the constructional positional dimensions. Thus the letter *A* with the figure *5* below it, contained in a small circle, means that the surface or feature to which it refers is part of the *A* functional train and can vary from the design position with a total run-out equal to 0.005 inch. This includes errors in squareness as well as those of location. All positional measurements are made from the datum surfaces which are also marked *"A"* with a figure below it—often *"0"* (zero)—with a circle around them and, in addition, two smaller circles drawn above and below the enclosing circle to emphasize the fact that this is a datum surface for that particular functional train.

With this system of positional tolerance symbols goes a very definite interpretation in terms of the positional inspection gage. All of this can be presented best in a series of simple examples.

Positional Symbols Applied to Flange Coupling—The first example is a pair of flanges, Fig. 2, which are to be assembled to form a coupling. (One of these flanges is the same as that shown in Fig. 1.) One flange has on its face a cylindrical shoulder which fits into a corresponding recess in the face of the mating flange to align the two halves of the coupling. The bore has a double keyway to engage the keys on the mating

shaft. Six bolt holes, equally spaced around the specified bolt circle, receive the bolts which fasten the two flanges together.

This simple example contains two functional trains. The one marked with the letter *A* includes all positional features that control the mating of the two halves of the coupling with each other. The second functional train which is marked with the letter *B* includes all positional features that control the assembly of the keyed shafts and the flanges. Bolts of 1/2 inch in diameter are used to fasten the two flanges together.

The datums are always surfaces. They are the surfaces which must be used to register or locate the part in the positional gage and in the drill jig or other work-holding device. The datums for the *A* functional group in this example are the outside diameter or circumference of the centering pilot on one flange, the outside diameter of the centering recess in the other, and the face of each flange. The centering feature positions the gage while the face of the flange squares it up.

When the positional symbol is placed near a dimension, or when the line from it goes to a dimension or dimension line, it always refers to the surface of the feature which is defined by that dimension. The positional symbol shown near the dimension which specifies the diameter of the bolt holes carries the figure *12*. This means that the run-out of the center of these holes from the exact position specified by the several positional dimensions must not exceed 0.012 inch. This permissible variation includes errors in the diameter of the bolt circle and errors in the accuracy of the indexing, as well as any departure from squareness of the axis of the holes.

The figure *0* carried by the *A* datum symbol, which is referred to the outside diameter of the pilot shoulder on the face of the first flange, means that the positional gage carries a recess or locating ring of the maximum metal size of that surface. The tolerance on the size or diameter of the datum is ignored in the design of the positional gage. The diameter of this shoulder is inspected for size independently of any positional inspection and to the specified limits of size.

The diameter of the bore for the flange carries an *A* positional symbol with the figure *1*. This means that the run-out of the center of this bore with the cylindrical pilot shoulder must not be greater than 0.001 inch—that is, when all sizes are to the maximum metal limits.

The positional gage for the *A* group of features or surfaces on the flange, which is shown

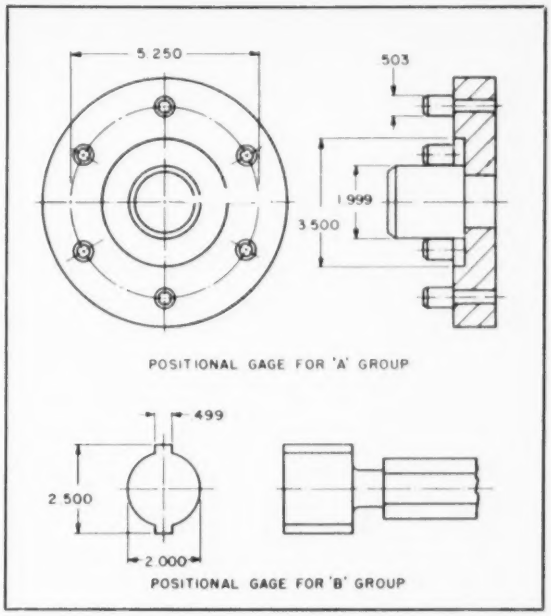


Fig. 3. (Top) Positional gage for *A* group of features on the flange shown at the top in Fig. 2. (Bottom) Positional gage for the *B* group of features

at the top in Fig. 2, is seen in Fig. 3. It consists of a circular plate (or square, if desired) with a cylindrical locating recess of the maximum metal size of the datum shoulder on the face of the flange. A stud that is concentric with the locating recess is made 0.001 inch smaller than the maximum metal size of the bore to check its eccentricity with the centering shoulder. It should be noted that the positional tolerance specifies the reduction in size of the gage element from the maximum metal size. The tolerance on the diameter of the bore is ignored in the design of these positional gages. If the true eccentricity between the two features is very important and must be definitely determined, then the letters *MEAS.* are given with the positional symbol. In such a case, the flange is mounted on a tapered mandrel that fits the bore and is set up on bench centers. Then the run-out of the shoulder on the face of the flange is measured with a dial indicator gage. The run-out is always twice the eccentricity.

To check the positions of the bolt holes, six studs, each 0.012 inch smaller in diameter than the maximum metal limit size of the bolt holes, are accurately spaced and positioned on the specified bolt circle. The tolerance on the diameter of these features is ignored in the design of the positional gage. The flange must center itself in the recess for the pilot shoulder and receive without interference the larger stud for the bore and the six smaller studs in the bolt holes.

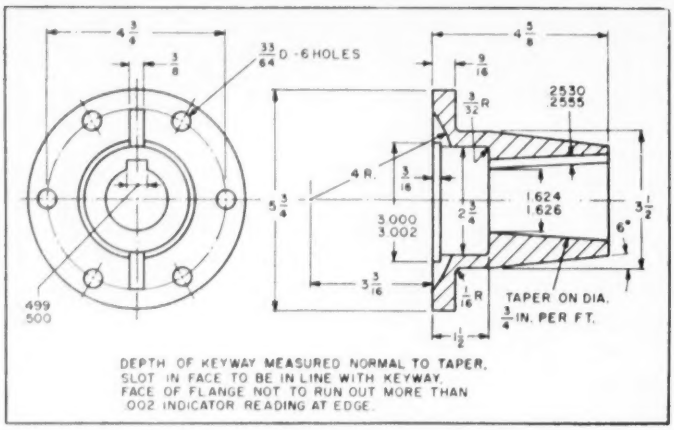


Fig. 4. The dimensional specifications for this SAE 2-inch Motorboat Propeller Shaft Coupling are the same as given in the SAE Handbook. These specifications could be expressed by positional tolerance symbols as shown in Fig. 5.

It has been noted that the tolerances on the conditions of size of the features are ignored in the design of the positional gages. This means that the actual variations in the position of features whose sizes are not to the maximum metal limits can be greater than the amount specified by the positional tolerances and still satisfy the requirements of the positional gage. When these positional dimensions control matching features of mating parts, then components with features near the minimum metal limit sizes can vary more in position and still assemble. Hence such seeming or technical violations of the positional tolerances are of no moment—components that meet the conditions of the positional gages will be interchangeable.

Except for the addition of the datum, this positional tolerance symbol and its interpretation or translation into inspection gages gives the same inspection gage design as the notes called for by the S A E Standard. Notes take up space on detail drawings. To include mention of the datum would require a longer note. The use of a simple symbol is much more concise and complete, a most desirable factor for detail drawings. The use of a symbol, in itself, is no innovation in drawing practice; there are already many other arbitrary symbols in common use on detail drawings to meet a variety of needs.

The positional gage for the *B* group of features is also shown in Fig. 3. Here the datum is the bore of the flange. The positional tolerance, or tolerance on symmetry, for the sides of the keyway gives the permissible error in symmetry. This is specified as 0.001 inch for its total run-out. The positional gage for this bore and keyways consists of a cylindrical plug gage with a double key, the diameter of which is made to the maximum metal limit size of the bore. The width of the keys is made 0.001 inch less than the maximum metal width of the keyway to allow for the tolerance specified for the symmetry of its position. This positional gage must pass through the bore of the flange without forcing.

The positional tolerances for the mating flange are similar in all respects to those of the first flange. The only difference between the positional gages for the *A* group of features for both flanges is the substitution of a cylindrical shoulder to fit the datum recess in the face of the flange in place of the recess to fit the datum shoulder on the first flange. The positional gage

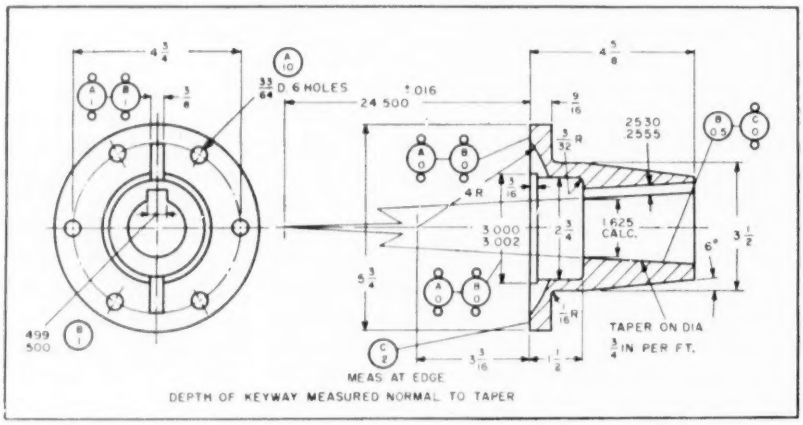


Fig. 5. Three groups of positional symbols are required to specify the shaft coupling shown in Fig. 4. The B and C groups are allied and would ordinarily carry the same letter symbol except for the fact that a different datum is required for the C group.

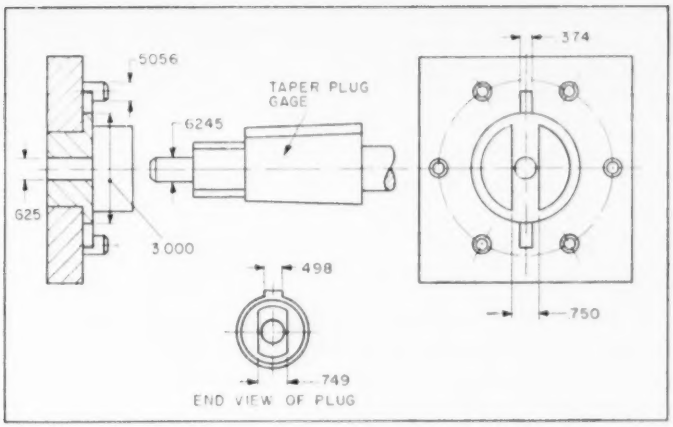


Fig. 6. Gage employed to inspect the positional relations of the shaft coupling shown in Fig. 5. It consists of a flat plate with a 3-inch diameter locating shoulder to engage the centering recess in the flange face.

for the bore and keyways is identical to the one shown in Fig. 3. Any parts which are acceptable to these positional gages—and also to the several limit gages for the individual features—will certainly assemble together and receive the 1/2-inch bolts in all mating holes without interference.

The angular positions of the bolt holes in the preceding example have no angular datum. The angular relation of the bolt holes in reference to the positions of the keyways is of no importance in this example. Only their positions relative to each other and to the bore of the flange are important. The next example is similar to the first in many respects but it includes an angular datum.

Positional Symbols Applied to Component with Angular Datum—The second example given to show the application of the positional tolerance symbols is the S A E 2-inch Motorboat Propeller Shaft Coupling. The dimensional specifications as given in the *S A E Handbook* are shown in Fig. 4. Two notes are included there. One refers to the amount of permissible run-out of the edge of the face of the flange in relation to the tapered bore. The other refers to the alignment of the slot in the face of the flange and the keyway in the tapered bore. These notes can be covered by the use of the positional tolerance symbols.

The same dimensional specifications are expressed in Fig. 5 with the introduction of the positional tolerance symbols. In this second drawing, the tapered bore is defined and controlled by expressing the distance from the apex of the taper cone to the face of the flange, since this is the most essential relationship. It is assumed, in addition, that the bolt holes are positioned in relation to the slot in the face of the flange as shown by the detail drawing. No definite note to this effect is given, but the assembly conditions appear to demand this and the drill jig for the bolt holes probably locates the half-coupling from the slot in the face of the flange.

Three groups of positional symbols are given here. The *A* group controls the assembly of the two halves of the coupling. The *B* group controls the alignment of the slot in the face of the flange and the shaft keyway, as well as the permissible eccentricity of the centering recess in the face of the flange with the tapered bore for the shaft. The *C* group controls the squareness of the face of the flange with the tapered bore for the shaft. Both the *B* and *C* groups are closely allied and would ordinarily carry the same letter symbol except for the condition that a different datum is required for the *C* group of positional relationships.

The datums for the *A* group of features are the face of the flange, the cylindrical centering recess in the face of the flange, and the slot in the face of the flange. This last datum has a positional tolerance of 0.001 inch to take care of the possible error of symmetry in this feature. In this positional group, the positions of the six bolt holes are controlled from these three datums.

The datums for the *B* group of features are the same as those for the *A* group. The alignment of the keyway in the tapered bore for the shaft and the eccentricity of this tapered bore in relation to the cylindrical centering recess in the face of the flange are controlled from these datums.

The datum for the *C* group of features is the tapered bore for the shaft. With such a tapered surface, and when no specific angular position is involved, only a single datum is needed. The squareness of the face of the flange is controlled from this datum. The positional tolerance symbol is given with this note: *MEAS. AT EDGE*, which calls for a dial indicator gage reading at the edge of the flange. The figure given in the positional tolerance symbol is the total permissible run-out, or movement of the hand of the dial.

Generally, with three functional groups of positional dimensions, three positional gages are

required. In this case, however, as the first two groups of features have the same datums and the third calls for a definite dial indicator gage reading, a single positional gage can be made to inspect these positional relationships.

A positional gage for this purpose is shown in Fig. 6. It consists of a flat plate (circular or square as may be desired) with a locating shoulder 3.000 inches in diameter to engage the cylindrical centering recess in the flange face and a lug or key to engage the slot in the face of the flange. This key is made 0.001 inch narrower than the maximum metal width of the slot (0.374 inch wide) to allow for the tolerance in symmetry for this slot.

Six pins or studs, 0.5056 inch in diameter, accurately spaced around on the specified bolt circle and positioned in relation to the slot, must engage the bolt holes without interference when the coupling is placed in position over the datum features of the gage. These pins are made 0.010 inch smaller in diameter than the specified maximum metal diameter of the bolt holes to allow for the positional tolerance of the same amount which is specified for the location of these holes.

A cylindrical hole, say 0.625 inch in diameter, is provided at the center of the gage-plate to engage with a cylindrical extension of the tapered plug gage which engages the tapered bore for the shaft. This cylindrical extension is made 0.6245 inch in diameter—0.005 inch smaller in diameter than the diameter of the hole in the center of the gage to allow for the eccentricity or positional tolerance specified between the axes of the centering recess in the face of the flange and the tapered bore for the shaft. An accurate slot, say 0.750 inch in width, accurately aligned with the key for the slot in the face of the flange, is also provided on the gage-plate. The taper plug gage has a key, 0.498 inch in width, to engage the keyway in the tapered bore for the shaft, and also has two parallel flat surfaces, 0.749 inch apart, on the sides of the cylindrical extension of the taper plug gage for the bore to engage the slot in the gage-plate and allow for the positional tolerance for the position of the keyway.

The mating coupling (not shown) is a duplicate of the one seen in Fig. 5 except that it has a male pilot, 1/8 inch high, with a diameter be-

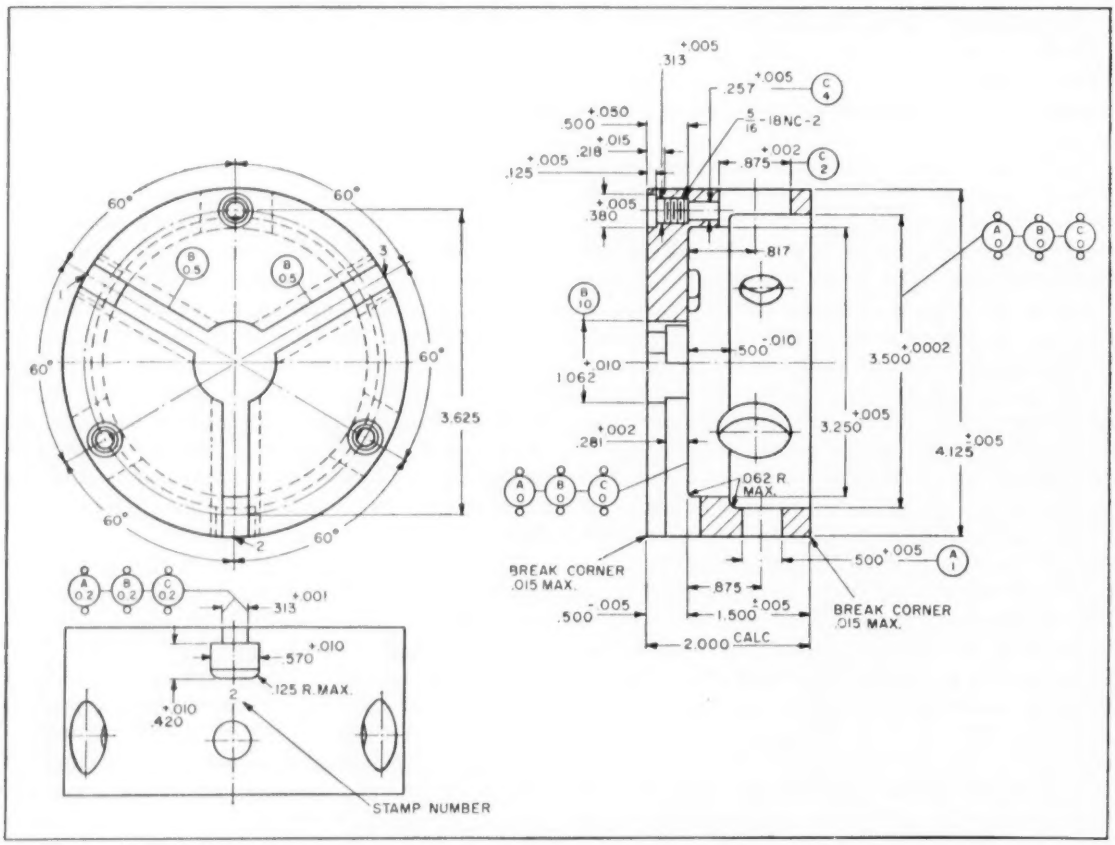
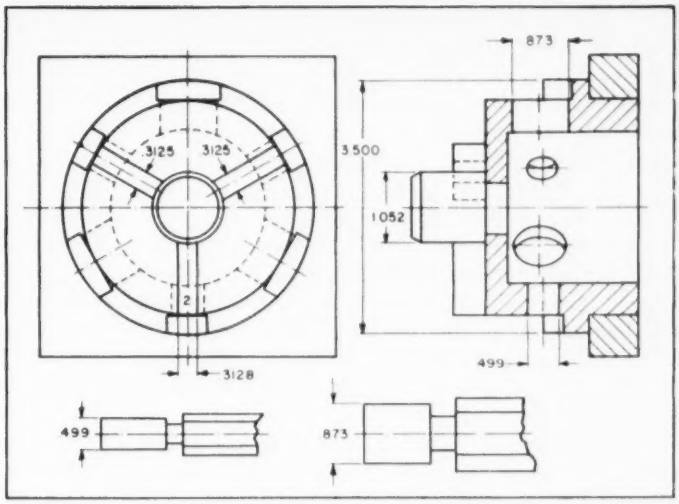
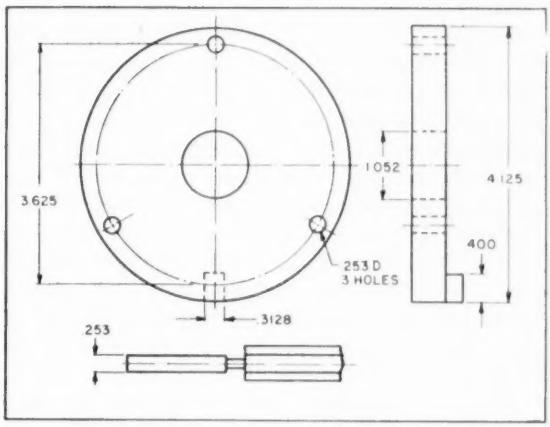


Fig. 7. This three-jaw chuck housing has several functional trains as well as datums and positional tolerances in three planes. In this example, three groups of functional trains requiring positional tolerances are involved.

Fig. 8. (Right) This positional gage, together with several accessories, can be used to inspect all three functional trains of housing shown in Fig. 7.

Fig. 9. (Below) This flange, when employed as an accessory to the gage shown in Fig. 8, can be used to check the location of the holes for the pinion retaining pins in the face of the chuck housing, Fig. 7





tween the sizes of 3.000 inches and 2.998 inches instead of the recess in the face of the flange. The dimensioning of this mating coupling and its positional gages is the same as for the first coupling except that a recess is provided in the positional gage to receive the male pilot.

Positional Control of Complex Components—For components of more complex design, the positional gages may involve positional control in three or more planes. Some of these positional gages need to be designed along lines similar to the design of drill jigs. In many such cases, the pins or studs that engage the holes in the components cannot remain fixed in position on the positional gages but must be made to engage the holes in the components through bushings located in the positional gages.

In such cases, these plugs and bushings may be made smaller than the maximum metal sizes of the holes they engage by the amount specified by the positional tolerance, and pass through or enter into snug-fitting bushings. In other cases, the plugs may be made to the maximum metal limit sizes of the holes they engage and pass through bushings which are over size by the amount specified by the positional tolerances. Each case may present some perplexing problems that require careful design effort to solve, both on the part of the designer of the component and on the part of the designer of the positional gages. At times, it is well for the designer of the component to also design the positional gage.

If parts made in different factories are to be completely or universally interchangeable, these positional gages are essential. A percentage inspection with these positional gages is generally adequate—possibly a first-piece inspection after each new set-up for production will give an adequate control. But the positional gages must be available whenever they are needed.

Positional Gages for Housing of Chuck—The third example is the outside component or housing of the small three-jaw chuck described in June, 1953, MACHINERY. This example contains several functional trains as well as datums and positional tolerances in three planes. The detail drawing of this housing containing the dimensional specifications is shown in Fig. 7.

This component has three groups of functional trains involving positional tolerances. The *A* group of features consists of the several features that control the position of the body of the chuck in the housing as well as those which hold it there. The *B* group consists of the features that control the positions of the three jaws in the face of the housing. The *C* group consists of the features that control the positions of the three bevel pinions that engage the bevel gear feature at the back face of the spiral scroll.

The datums for the *A* group of positional dimensions are the bottom face of the recess in

the housing for all positions in the axial direction, the internal cylindrical surface of the larger recess at the rear end of the housing for the diametral or concentric positions, and the narrower slot in the face of the housing which receives the No. 2 jaw for all angular positions. This last datum has a small positional tolerance to allow for errors in symmetry of this slot.

The three holes, 0.500 inch in diameter in the shell of the housing, receive three pins which extend into the body of this chuck and act to hold the body in tight engagement, axially, with the housing. The positions of these three holes, with the datums, comprise the *A* positional group of dimensions.

The datums for the *B* group of positional dimensions are the same as those for the *A* group. The remainder of this functional train consists of the positions of the other two slots for the jaws in the face of the housing. The axial positions of these jaws are directly controlled by the tolerance on the dimension between the bottom face of the recess in the housing and the forward surfaces of the enlarged portions of the slots for the jaws. This group also contains the small clearance hole at the center of the face of the housing.

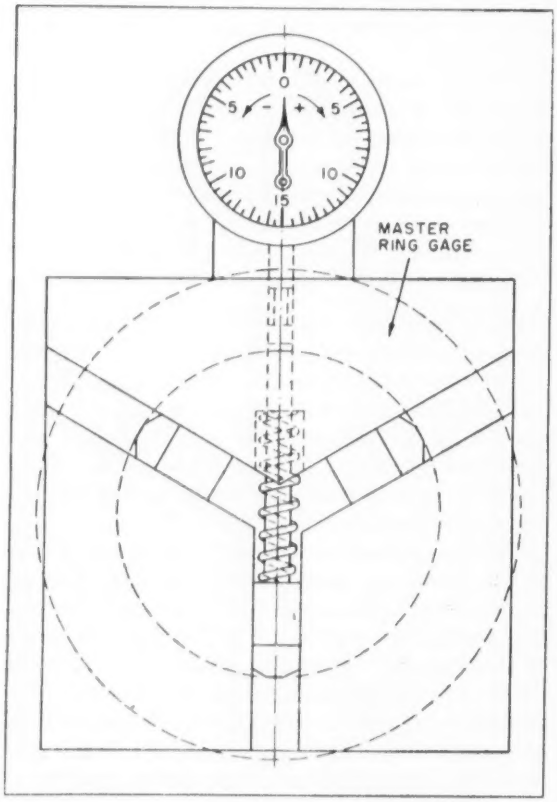


Fig. 10. To inspect the larger bore of the chuck housing shown in Fig. 7, a dial gage comparator of the type here shown must be used. The tolerance involved is too small to permit use of limit gages of fixed size.

The datums for the *C* group of positional dimensions are also the same as those for the two preceding groups. The remainder of this functional train consists of the three radial holes, 0.875 inch in diameter, which receive the heads or flanges of the three bevel pinions that engage the bevel gear feature at the back face of the spiral scroll; and the three holes, 0.257 inch in diameter, that receive the pins with the flattened ends which fit the grooves under the heads of the bevel pinions and thus retain them in their axial positions. The outer ends of these last three holes are counterbored and threaded to receive the retaining screws. For these features the essential locations are those of the holes which receive the retaining pins.

Since all of these three functional trains have the same datums, a single positional gage, with several accessories, can be made to inspect them. The design of such a gage is shown in Fig. 8. It consists of a plate on which is fastened a generally cylindrical hub which contains various locating features. The datum surfaces of this gage are the larger diameter at the base of this hub, its top face, and the sides of the key on the face of the hub which engages the slot for the No. 2 jaw. This key is made 0.0002 inch smaller in width than the maximum metal limit size of the width of the slot to allow for the permissible error in symmetry.

Three of the pilot holes provided in this hub receive the three plug gages, each 0.001 inch smaller in diameter than the maximum metal limit size of the holes, for the holding pins of the body of the chuck. This covers the inspection of the positions of the *A* functional group. The housing is placed over the hub of the gage with the datum key engaged with the No. 2 slot for the jaws. Then the three plug gages for the holes are inserted through the housing. They must enter without forcing into the corresponding pilot holes in the hub of the positional gage. These pilot holes in the hub must be a snug fit on the plug gages.

For the *B* functional group, two additional keys are fastened to the face of the hub of the positional gage to verify the positions of the other two slots for the jaws in the face of the housing. These keys are made 0.0005 inch narrower in width than the maximum metal limit width of these slots to allow for the error in position and symmetry of these slots. In addition, a small stud, 0.010 inch smaller in diameter than the maximum metal limit size of the clearance hole at the center of the face of the housing, is provided at the end of the hub on the positional

gage to check the eccentricity of this clearance hole.

For the *C* functional group, three pilot holes are provided in the hub of the positional gage to receive three plug gages, each 0.002 inch smaller in diameter than the maximum metal limit size of the holes in the housing which receive flanges of the bevel pinions, to check the positional tolerances for the location of these features.

When the housing is in position on the positional gage, the three plug gages must enter the pilot holes in the hub of the positional gage, through the holes in the shell of the housing, without forcing. As before, these plug gages must be a snug fit in the pilot holes in the hub of the positional gage.

Another accessory is added to this positional gage to check the locations of the holes for the pinion retaining pins in the face of the housing. This accessory consists of the flange which is shown in Fig. 9, with a small hole in its center to fit the stud for the clearance hole at the center of the face of the housing and a short key to fit the outer part of the No. 2 datum slot in the face of the housing. Three holes, accurately located to the positions of the holes for the pinion retaining pins (each 0.004 inch smaller in diameter than the maximum metal limit size of these holes to allow for the tolerance in their position) are also carried on the face of this accessory flange. A plug of the same size is inserted successively through these holes to check the location of the holes for the pinion retaining pins.

Limit Gages for Housing of Chuck—If this component is made in quantity and if it must be universally interchangeable, additional gages are required to inspect the several dimensions of size, form, and position. To complete this example, all of the dimensional specifications given on the detail drawing are translated into terms of definite inspection gages. Where these gages are limit gages of conventional design, they are specified by size and type only. In all other cases, a sketch of the gage is included to complete the description. These other dimensional specifications and their respective gages are grouped with the functional trains to which they belong. Some of them, however, relate to the general form or structure of the component and not to any specific functional train. These are given first.

The first of these general dimensions is the outside diameter of the housing. The gage for this could be an adjustable limit snap gage set to the values of 4.130 inches for the GO size and 4.120 inches for the NOT GO size. Another general dimension is that for the smaller diameter of the recess in the housing. This is a

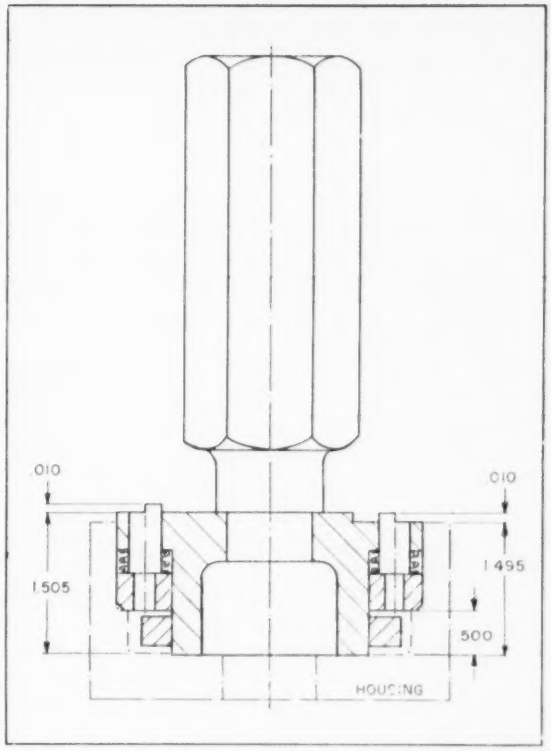


Fig. 11. The gage to check the total depth of the recess in the body of the chuck housing may be either a simple depth gage or a combination gage used also to inspect the depth of the larger recess. The gage here shown is of the latter type.

clearance surface in relation to both the body of the chuck and the spiral scroll. The gages for this are two cylindrical plug gages, 3.250 inches for the diameter of the GO size and 3.255 inches for the diameter of the NOT GO size. These tolerances are ample for work produced by boring in a chucking machine. If difficulties are met in production because of the smallness of this tolerance, the tolerance should be increased to meet the manufacturing needs. As long as interference with mating parts is avoided, these surfaces are merely structural and have no influence on the functional operation of the chuck.

The *A* group of dimensions relates to the assembly of the body with the housing of the chuck. The larger bore of the housing, which is also one of the datum surfaces, fits a shoulder on the body and hence belongs with the *A* group. The tolerance specified for this feature is practically a gage tolerance. This surface must be produced or finished by grinding on an internal grinding machine with an automatic sizing device. Here, any variation in size will be reflected as a variation in the accuracy of the centering of the work in the chuck. Hence the tolerance originally specified is as small as there is any hope of

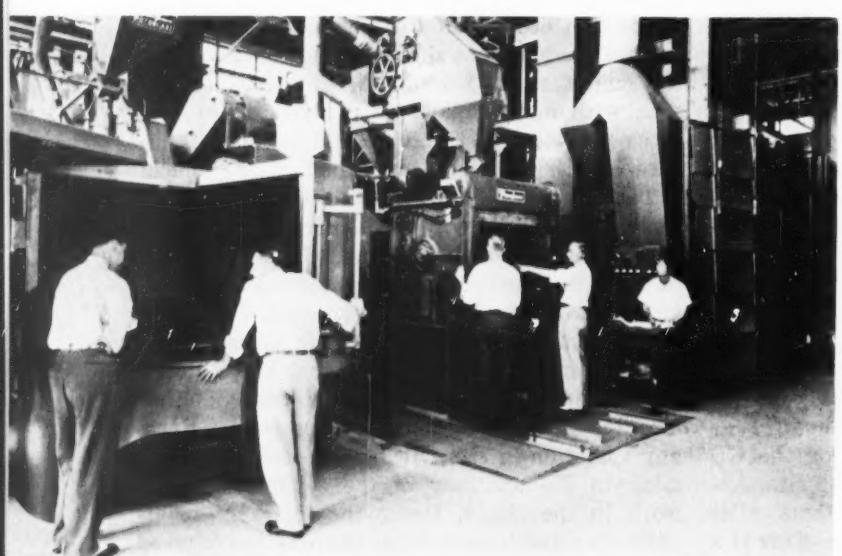
maintaining in actual production. Perhaps this hope is more optimistic than the practical possibilities. If so, as soon as the best obtainable results are determined, this value must be revised to agree with the actual performance. If this results in too large an error in the centering of the work in the assembled chuck, then the practices and the actual sizes must be rearranged to allow for selective assembly instead of universal interchangeability. The functional requirement of accurate centering of the work must be met, regardless of difficulties.

With such a small tolerance, limit gages of fixed size are out of the question. Some form of comparator must be used to inspect this feature. Many types are available on the market today. One such comparator is shown in Fig. 10. This consists of a frame carrying two fixed points, or fingers, with a third movable finger, the position of which is registered by a dial indicator gage. A master ring gage, of maximum metal size, is also provided to adjust the setting of the dial of the indicator to the zero position.

The total depth of the recess in the body of the housing is also related to the *A* functional group. This is the distance from the datum surface at the bottom of the recess to the rear face of the housing. This distance must match, within reasonable limits, the total length of the body which is assembled into this recess. Too great a difference in these sizes would spoil the appearance of the assembled chuck. The gage for this dimension may be a simple depth gage or it may be combined with a gage to inspect the depth of the larger recess, and thus provide for a more rapid means of inspection.

Such a combined gage is shown in Fig. 11. The body of the gage forms the depth gage for the total depth of the recess. The end of this gage will register against the bottom of the recess in the housing. Steps are ground on the exposed end of the body of the gage so that the distance from the end of the gage to the GO step is 1.495 inches and the distance to the NOT GO step is 1.505 inches. In operation, the end of the gage is in contact with the bottom of the recess in the housing. The GO step must then be flush with or below the rear face of the housing. The NOT GO step must never be below the rear face.

A sliding ring or sleeve is mounted on the body of the gage and retained, with suitable operating clearances, by a fixed ring or collar which is shrunk or pressed on the end of the body of the gage. Two small rods or stems are fastened to this sliding sleeve, with coiled compression springs assembled over them, and pass through freely fitting holes in the body of the gage, as shown in Fig. 11. In operation, the springs will hold the sliding sleeve of the gage in engagement with the shoulder at the end of the smaller bore in the housing. The exposed ends of the small rods have steps to register against the two steps on the body of the gage. When the distance from the datum surface at the bottom of the recess in the housing, which is in contact with the end of the body of the gage, to the bottom of the sliding sleeve is equal to 0.500 inch, the GO steps on both small rods are flush with the respective step surfaces of the body of the gage where they emerge. The NOT GO steps on both small rods then project the amount of the tolerance (0.010 inch) beyond the respective step surfaces.



Standard size blast-cleaning and dust-collecting equipment is installed in this demonstration room located at the Hagerstown, Md., plant of the Pangborn Corporation. The room was developed to facilitate the solving of blast-cleaning and dust-control problems in the shortest possible time. Complete reports are submitted to any customer who sends samples to the demonstration room for cleaning. These reports include recommendations for blast-cleaning equipment, sizes and types of abrasives to be used, duration of blast time, and other important information

Flow-Form Dimpling at Northrop

By Gilbert C. Close

COUNTERSUNK holes for flush-head rivets and screws are now hot-coined in many types of metal sheet at the Northrup Aircraft Corporation, Hawthorne, Calif. Termed "flow-form dimpling," the new method employs dies that are heated by electrical resistance. The countersunk holes, or dimples, as they are commonly referred to, are being successfully formed in some alloys for the first time. All tests to date indicate that these sheets have 15 per cent more strength than when the same dimple configuration is formed cold.

Problems involved in producing dimples have multiplied in direct proportion to increases in airframe strength requirements and aerodynamic efficiency. There is a need for stronger, heavier sheet alloys having constantly more restricting specifications for surface finish. It is essential that the dimple does not crack during forming or after assembly of the sheet. The dimple must be dimensionally accurate to insure fastener flushness and to nest correctly in either machined countersunk recesses or in other dimpled recesses, regardless of sheet thickness. Furthermore, the dimple must provide maximum joint strength under all conditions, at the same time developing the very minimum of warpage or distortion in the sheet. Production-wise, the dimpling method must be rapid and accurate, and at the same time require simple, inexpensive tools and set ups.

Flow-form dimpling applies a proper amount

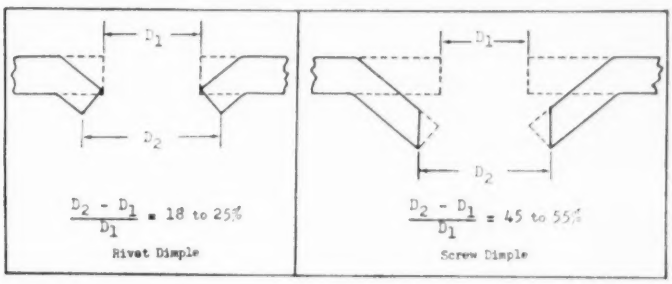


Fig. 1. Equations used to approximate metal elongation during dimpling for rivets (left) and screws (right)

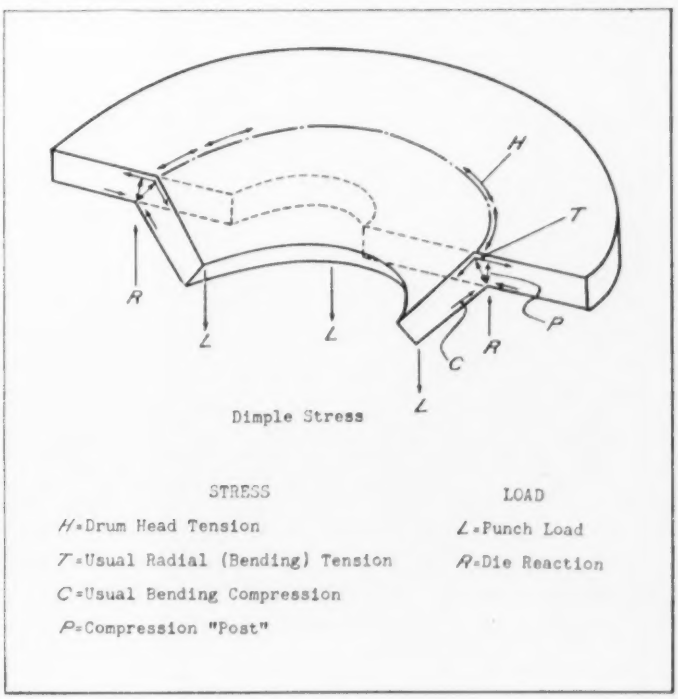


Fig. 2. Arrows in this diagram represent the multi-axial stress patterns that develop during dimpling.

Fig. 3. Here the operator is in the process of hot-dimpling a test strip on one of the stationary machines employed for larger sheets.

of heat to the material, increasing the flow of the metal and reducing its tendency to crack. Residual stresses are held down, and there is less danger of subsequent fatigue failure in the dimpled area. Thicknesses up to 0.125 inch, single or in combination, can be successfully dimpled hot. Surfaces to be dimpled need not be cleaned of paint or primer. Although hot-coining is slightly slower than some other dimpling methods, it is substantially faster than machine countersinking.

Metals that in the past could not be dimpled cold, but are now successfully handled with heated coining dies, include magnesium, titanium, and stainless-steel alloys. Aluminum alloys are also handled—75S-T, 24S-T86, and (clad) 14S-T6—and 24S-T when the countersunk fasteners are 1/4 inch, or more, in diameter.

Taking 75S-T as an example, cold-dimpling with this alloy has always been troublesome, because of radial and internal shear cracks that developed as a result of insufficient ductility at room temperature. Its local elongation at fracture at room temperature is 25 to 35 per cent (as against 40 to 50 per cent for 24S-T) so that rivet dimpling was always marginal and screw dimpling impractical where high side-wall coining was required. Equations for calculating metal elongation during dimpling are given in Fig. 1.

On the other hand, at the elevated temperature of the flow-form method, work-hardening, or embrittlement, has been largely dispensed with, so that the sheet retains its strength and ductility. The multi-axial stress patterns that develop during the formation of a dimple can be seen in Fig. 2. Heat is used primarily to prevent these stresses from exceeding the ductility or fracture limit of the material.

The electrical resistance heaters used in flow-form dimpling are built integrally around the punch and die posts of the machine. To insure adequate heat transfer by conduction, the hot tools are brought into contact with the sheet for a predetermined length of time and at a predetermined pressure. Although the tool temperatures are high, they drop as the sheet picks up heat, the temperature of the tools and sheet being fairly well equalized at the moment the dimple is completed. Exactly how much heat is transferred from the tools to the sheet de-

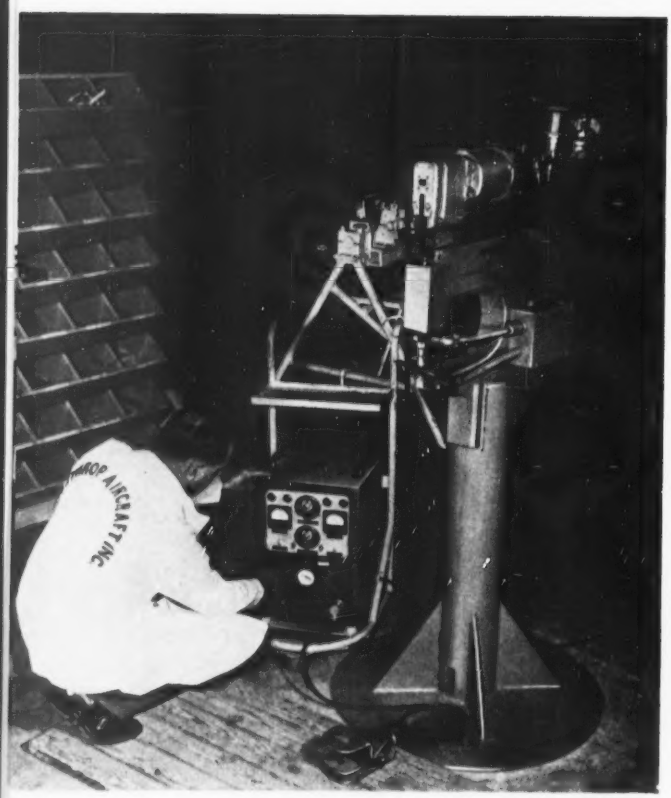
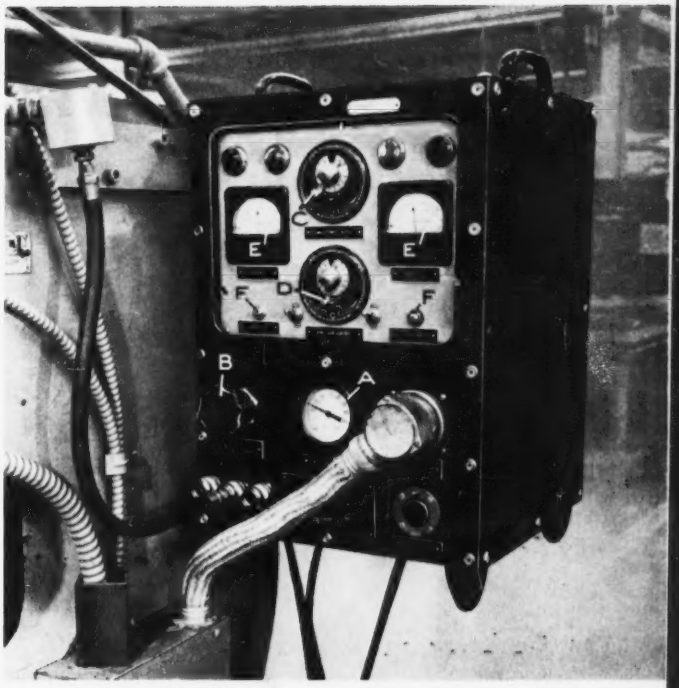


Fig. 4. Here the operator is seen adjusting the Thermotronic unit for one of the smaller pedestal type machines used on an intermediate class of work.

Fig. 5. The Thermotronic unit controls temperature, pressure, and dwell period so that perfect dimples are obtained on a high-production basis.



pends on the area of interface between them, as well as on the duration and pressure of the contact.

The temperature developed in the sheet is controlled by the sheet material (thickness, thermal conductivity, mean temperature rise, specific heat), the mass to be heated, and the size of the dimpled hole. For 75S-T6 aluminum alloy, the sheet should reach a temperature of between 300 and 355 degrees F., depending upon the factors mentioned. A higher temperature, 400 degrees F., was found to affect the strength of the sheet when held for twenty seconds, although when the dwell time was reduced to five seconds no damage was sustained.

Tests are run to establish die temperature and contact pressure for each size of fastener in the particular gage of material used. Other tests establish proper dwell periods for obtaining the desired rise in the temperature of the part. A complete inventory of test strips is maintained in each hot-dimpling location in the plant. Before production dimpling is started, the operator dimples several strips. Die temperatures can be checked with "Tempilstiks"—colored crayons that indicate different temperature ranges.

There are several different types of dimpling machines, or "squeezers," in use at Northrup. Stationary machines, as seen in Fig. 3, are used on large sheets. These dimplers have a throat depth of 24 inches and a throat opening of 8 inches. Smaller machines, as shown in Fig. 4, are welded to a pedestal, and used on an intermediate class of work. They have a throat depth of 7 inches and a throat opening of 2 1/2 inches. Portable squeezers are used on work that cannot be moved. They have integral heaters, and are available in different throat depths, from 5/8 inch to 2 inches.

A thermal bucking-bar and rivet gun are used for dimpling the middle area of a sheet that is not accessible to any of the squeezers. Both the bar and the gun are vibrated simultaneously by a controlled flow of air. This equipment requires the services of a skilled operator, since the transfer and control of the heat are largely dependent on the pressure used when the heater face is held against the material.

Each dimpling machine and bucking-bar has a heat control unit, one of which is shown in a close-up view in Fig. 5. Dwell pressure, indicated on gage *A*, can be regulated from wheel *B*. Dwell period can be regulated from control *C*. For rivet-gun use, control *D* is set to deliver the desired number of blows. Pyrometers *E* show actual tool temperatures at all times, temperatures for the punch and the die being individually adjustable from controls *F*.

The small, low-voltage resistance heaters around the punch and die posts are capable of generating heat faster than it can be absorbed by even the heaviest gage sheet to be dimpled. They are rugged and shockproof, and can be adjusted to any slight misalignment in the machine. Thermo-couples are located at the base of the dies, so that they measure the actual die temperature, rather than that of the heaters.

Dimpling dies are chromium-plated for hardness. Their flat base permits them to be held in position by lock-collars, thus eliminating retainer rings and set-screws. Dies can be changed rapidly and operating temperature reached within two minutes. Formerly, preheat standby units were employed, and it required between thirty-five and forty-five minutes for the dies to reach operating temperature.

* * *

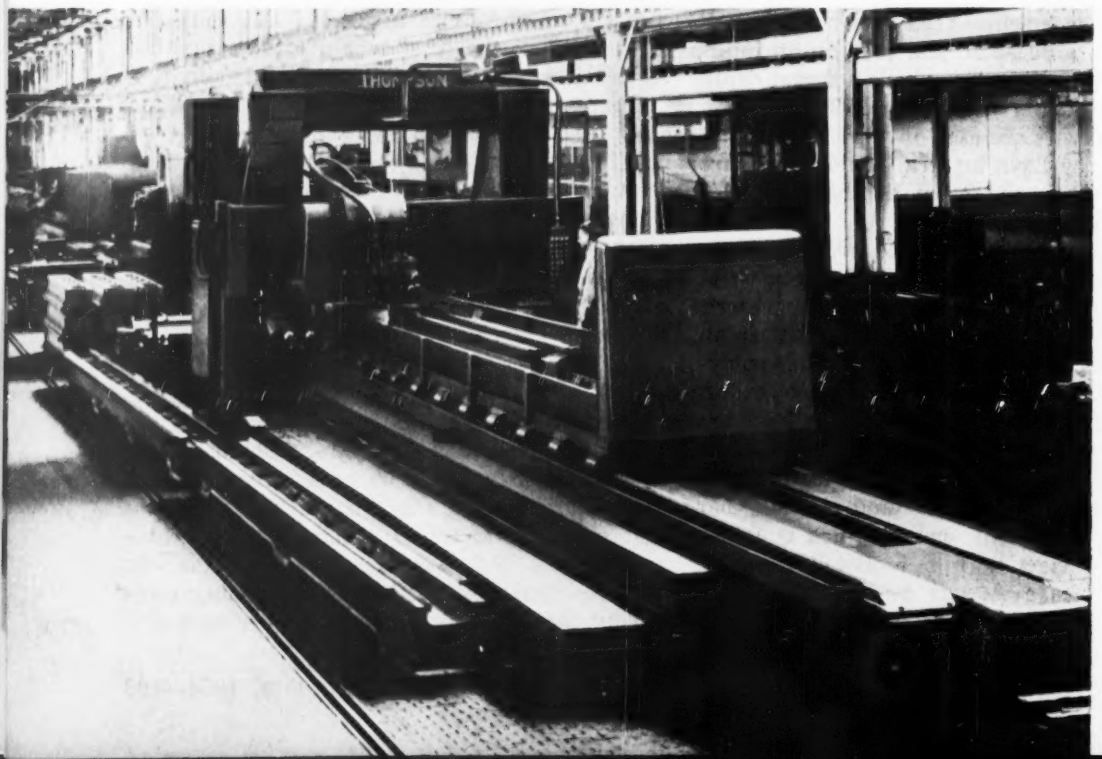
Volume production plus cost-reduction efforts by aircraft manufacturers reduce the unit cost of military planes. One manufacturer reports that price per airframe pound of a jet fighter was reduced 52.3 per cent while the plane was in production, despite the fact that labor costs during the same period rose 40.9 per cent.

In Shops Around

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

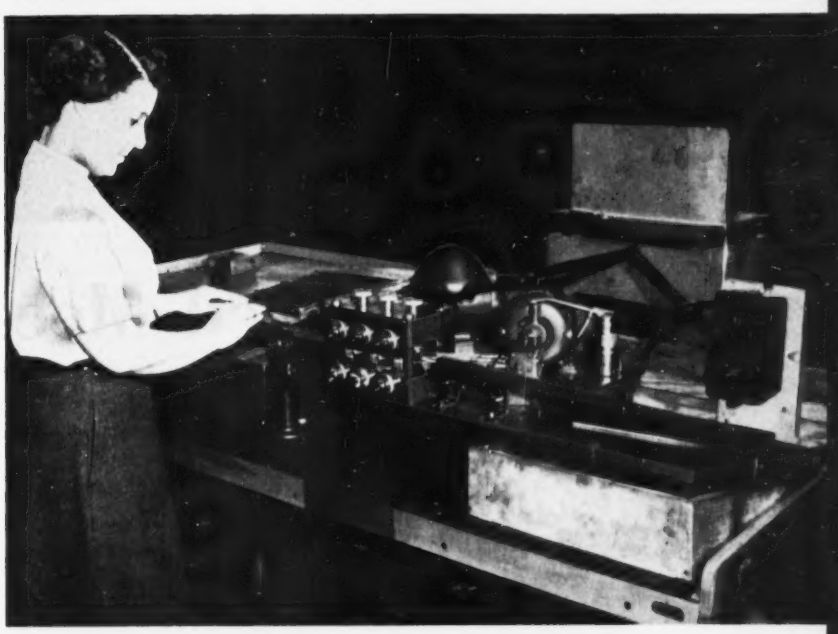
A lower electrode that can be hydraulically rotated out of its normal vertical position is a feature of a battery of Federal spot-welding machines at the Ryan Aeronautical Co., San Diego, Calif. The electrode was designed by Ryan personnel. It increases the capacity of the machine, and permits a single worker to handle unwieldy jobs.

Grinding lathe bedways at the Monarch Machine Tool Co., Sidney, Ohio. The new Thompson machine, constructed on the planer principle, accommodates two grinding wheels up to 24 inches in diameter. Reported to be one of the largest units of its type ever built, the 79-foot long grinder maintains an accuracy of 0.0005 inch from end to end.

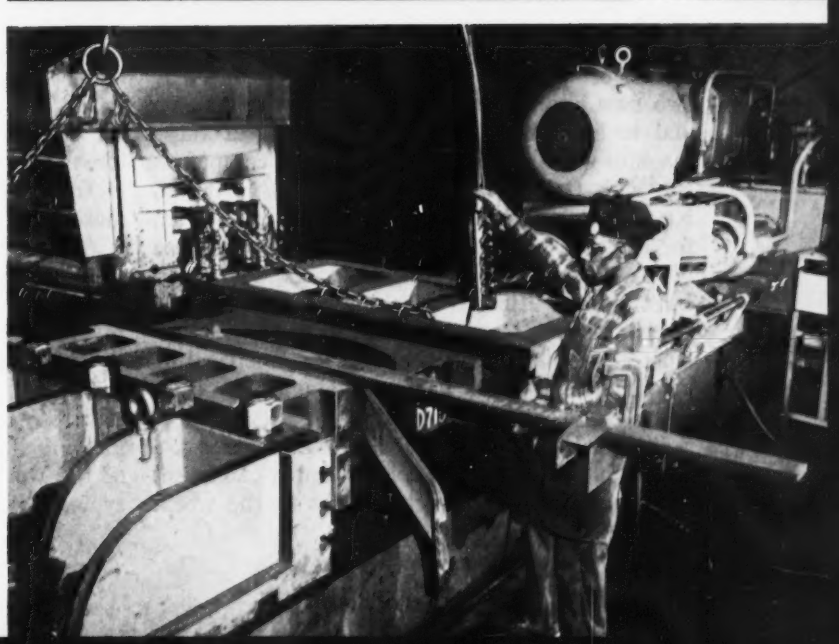


the Country

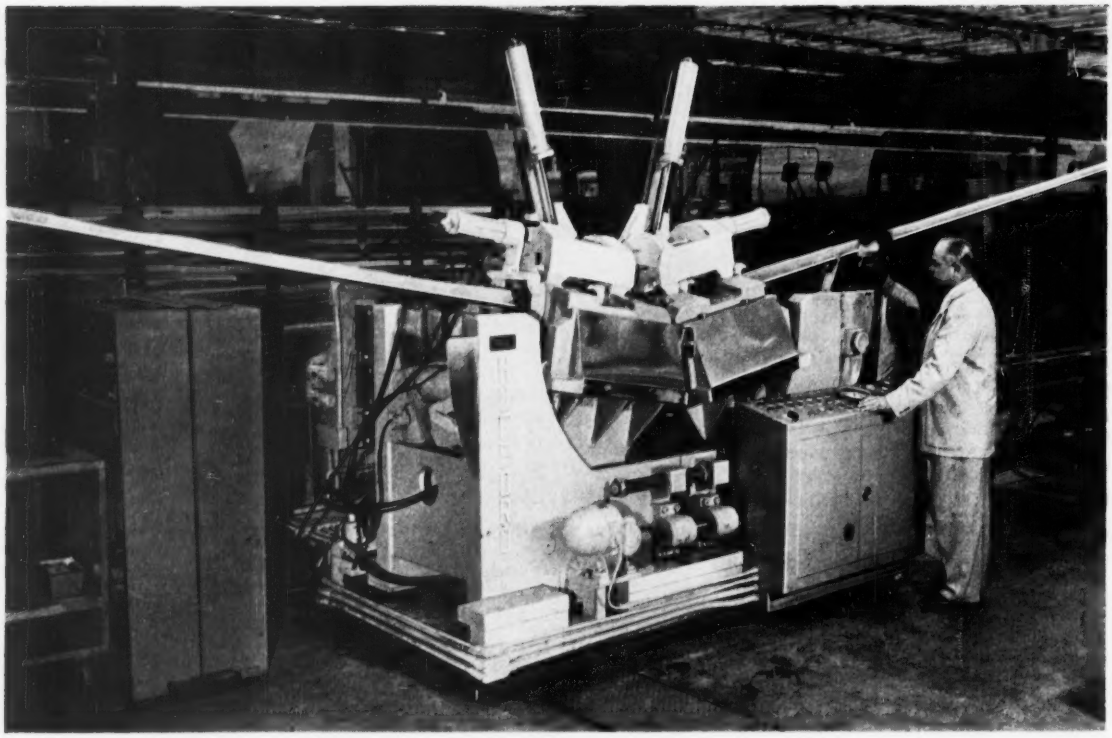
Removing rubber pads from airframes with the aid of dry ice at the Consolidated Vultee Aircraft Corporation, San Diego, Calif. The costly 4-inch square pads ($12 each) are glued to surfaces for test purposes. With dry ice, the pads come off easily and in good condition. Former methods destroyed the pads and they could not be re-used.



Straightening small-diameter steel shafts on a Mackintosh-Hemphill machine at the Burroughs Corporation, Detroit, Mich. Shafts are fed between six motor-driven rollers, then drop onto an inclined table. Those within straightness tolerance roll beneath a measuring bridge; others are reprocessed.



Bulldozing a part for a bulldozer—At the Joliet, Ill., plant of the Caterpillar Tractor Co., a Lake Erie 500-ton hydraulic bulldozer forms C-frame sections. Two such sections are welded together to hold the blade to the tractor. Because of ribs along outside of section, the work is formed cold.



Lockheed Mechanizes Extrusion Bending

By Fred C. Hoffman
Manufacturing Research Department
Lockheed Aircraft Corporation
Burbank, Calif.

BENDING beams and spar caps for Lockheed airframes in a fraction of the time of previous methods is performed by two new hydraulic machines—and without special tooling or skilled personnel. One of these machines has been installed in the company's Burbank, Calif., plant; the other, in the Wichita, Kan., plant of the Beech Aircraft Corporation, for use on Lockheed parts built by Beech. These benders, designed by Lockheed engineers and built by the Hufford Machine Works, Inc., El Segundo, Calif., accommodate extrusions of almost any cross-sectional shape—symmetrical or asymmetrical—and perform single or compound bends in one operation.

Included angles from 180 to 130 degrees are obtainable, and a rotational movement can be set up to produce or correct a twist in the work. Electric heating platens for hot-bending are readily installed. The last-mentioned feature is of much importance, because of the rather extensive use that is currently being made of the new high-strength 75S-T aluminum. Customary cold-bending methods—using Cerrobend, blocks, and dies—proved impractical for this material.

A close-up view of the bender is shown in Fig. 1. The work *A* is supported in the saddles of two cradles *B*, the area at which the bend is to be made being between the cradles. During the bending cycle, hydraulic cylinders in the ends *C* of the base cause the cradles to pivot toward each other in a vertical plane. (The heading illustration shows the angular position of the work and cradles at the completion of a typical cycle.)

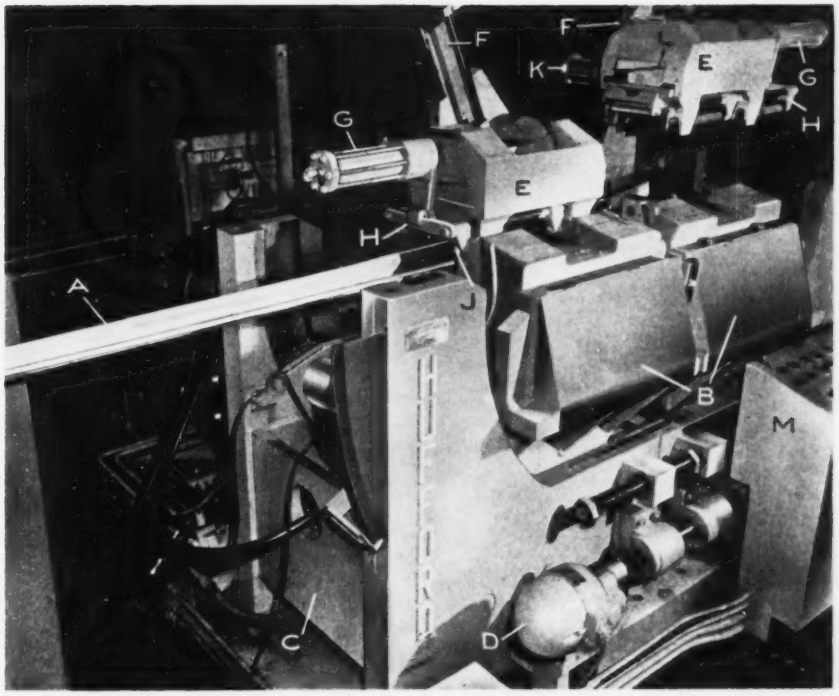


Fig. 1. No foundation pit is required for this bender. Together with the hydraulic unit and power cart, the bender can be relocated wherever it is needed.

Vickers hydraulic equipment is used in conjunction with the bender. Piping for the two cradles is directed through an equalizing valve, and both units are linked together mechanically to this valve so that they pivot the same amount and exert the same pressure. For the maximum bend (130 degrees), the cycle takes approximately eighteen seconds. A motor drive *D* can be actuated to adjust the center distance between the pivotal points of the cradles, in order to produce a variation of the radius of the bend in the work between 5 and 14 inches.

Directly over each cradle is a yoke *E*. To load or unload the work, the yokes are raised by lift cylinders *F*. (The right-hand yoke is shown in raised position.) When the yokes are lowered, locking cylinders *G* thrust rod-carriers *H* laterally into locating hobs in the inner shoes *J* of the cradles. Clamping cylinders *K*, two on each yoke, control wedges *L* which bear down on grippers to secure the work in position. All cylinders are actuated from the hydraulic system of the machine, and together with the bending cylinders, rotational cylinders, and cradle-ad-

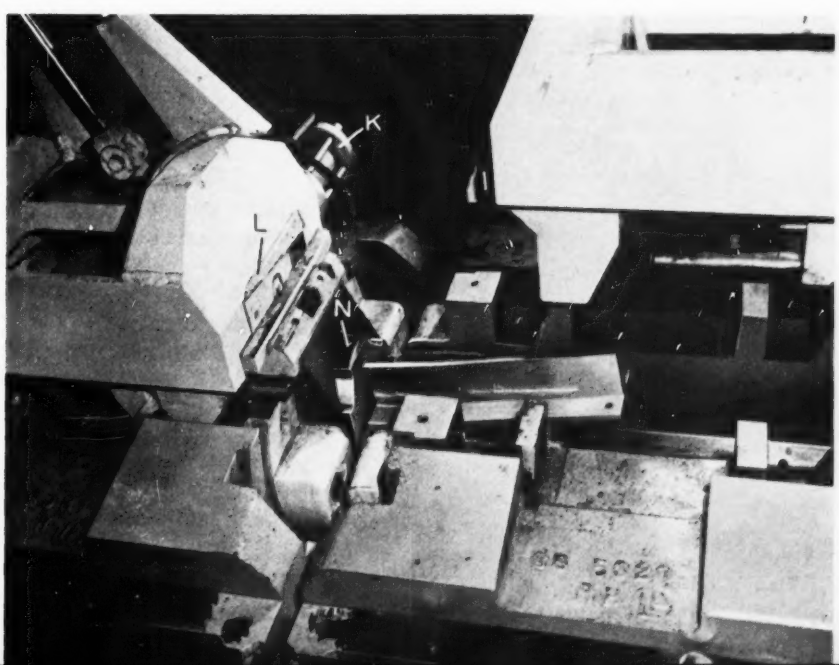


Fig. 2. Any shape of extrusion within the capacity of the machine can be accommodated. Only a pair of grippers is needed.

Fig. 3. Turning the handwheel moves a slide along the scale. A micro switch automatically ends the bending cycle at the desired angle.

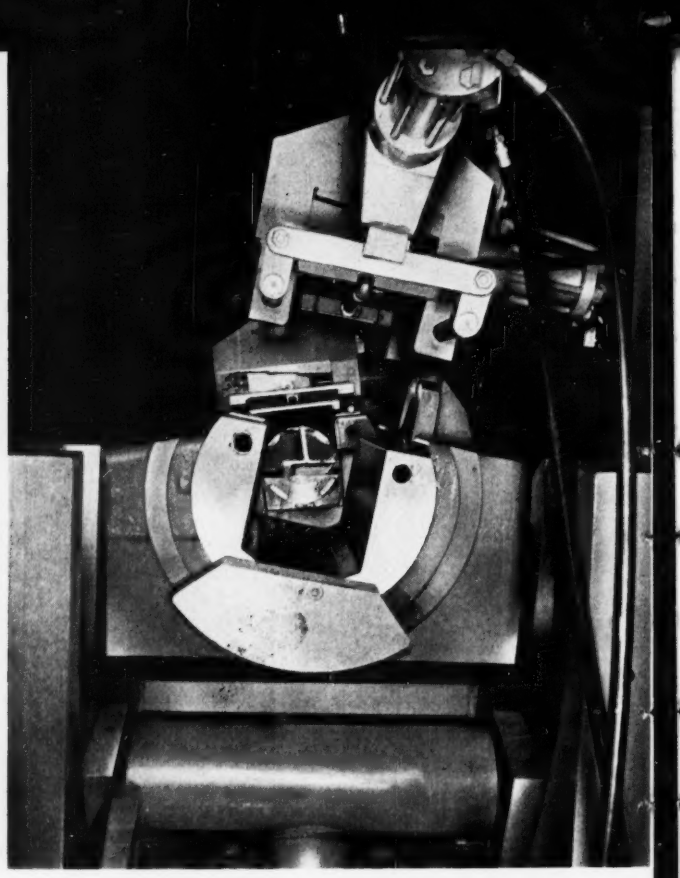


Fig. 4. A pair of hydraulic cylinders rotates the cradles to bend or unbend the work along its axis to produce or correct a twist.

justment motor, are controlled from a push-button panel *M*.

The view above the cradles, Fig. 2, shows the arrangement of the wedge *L* over the gripper *N*. Grippers are machined from square sections of stock to conform to the cross-section of the beam or spar cap. They are designed so that the neutral axis of the work coincides with the center line of the pivotal points of the cradles.

On the right-hand side of the machine is a handwheel *P*, Fig. 3, by which the cradle pivot can be set on a scale *Q* to obtain the desired included angle of bend. Scale calibrations are in 5-minute increments, from 0 to 25 degrees. Moving in a slot in the scale is a slide equipped with an adjustable micro switch. During the bending cycle, a pointer attached to the cradles contacts the micro switch, automatically terminating the bending cycle.

To obtain an included angle of 150 degrees,

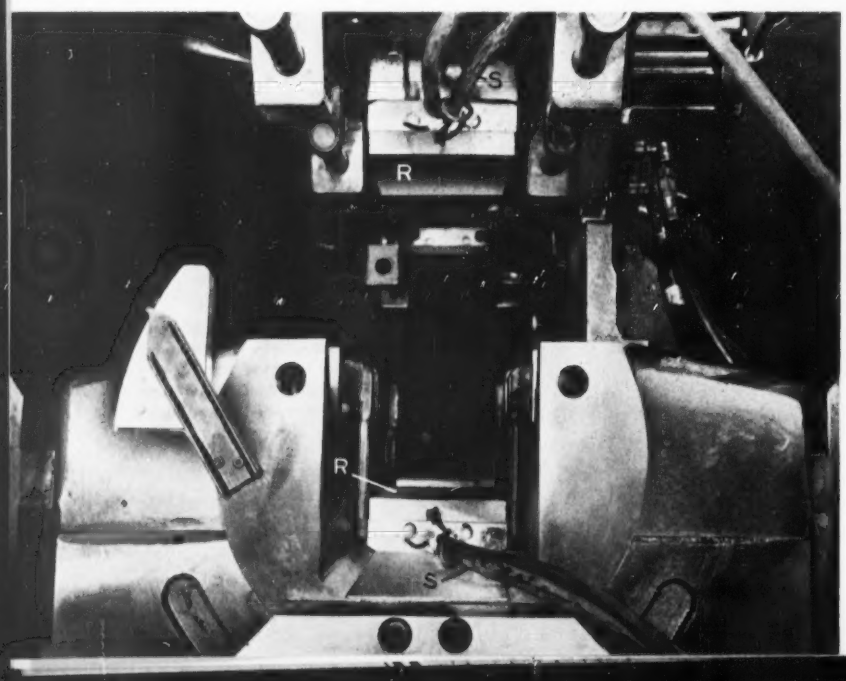


Fig. 5. Heating platens, essential for bending 75S-T6 aluminum, are installed in the yokes and cradles.

for example, the slide would be set at slightly more than 15 degrees, thus raising each leg of the bend that amount from the horizontal. The reason the cradle pivot is set above the exact value of the complement of one-half the included angle is to compensate for the inherent spring-back of the work, once bending forces have been released. Determining the spring-back allowance is a matter of experience; minor adjustments may be required after the first or second bending cycle. Where the spring-back has been incorrectly estimated, the machine can be reset and the work bent or unbent to the proper angle.

To produce or correct a twist in the work, the cradles can be hydraulically rotated, as seen in Fig. 4. They move independently and in opposing directions, up to 8 degrees each side of center. A valve on the control panel provides for variable pressures up to 2000 pounds per square inch.

For extrusions that are to be bent hot, platens *R*, Fig. 5, are installed in the saddles and yokes. Wiring *S* is connected to a power unit equipped to keep a close control over temperatures. Lockheed is hot-bending 75S-T6 aluminum at temperatures of from 275 to 325 degrees F. The heat-treating properties of the material are not affected by this temperature.

Machining Titanium Alloys

IN machining alloys of titanium, the Carboloy Department of the General Electric Co., Detroit, Mich., reports that excessive cratering on top of the tool is the cause of practically all tool failure. This condition can be reduced by using the proper grade of cemented carbide. With the use of suitable tooling, the work-piece may chatter if not adequately supported due to the low modulus of elasticity of titanium. One way to eliminate this vibration is to hone a 0.005- to 0.010-inch wide land on the cutting edge at an angle of 45 degrees. If this does not provide the desired results, reducing the feed may be the answer.

As hardness of the work material rises above 37 Rockwell C, tool life may be expected to fall sharply. Also, a carbon content of more than 0.2 per cent will reduce tool life because of the titanium carbides being formed. A variation of carbon below this figure may cause large differences in tool life. According to Carboloy engineers, tool life remains about the same when machining the various titanium alloys, provided they are in the same hardness range. Coolants of the synthetic emulsion type are beneficial to tool life, especially when the tool is flooded from the top, side, and bottom.

In the machining of titanium-alloy forgings, the cemented-carbide tools should have as large a nose radius as possible. The tool should be run at a speed of about 50 feet per minute with a 0.010- to 0.020-inch feed and a 1/4- to 1/2-inch depth of cut. For cuts more than 1/2 inch deep, a shear type tool should be used with a 40-degree negative back rake, 15-degree positive side rake, 15-degree side cutting-edge angle, and a 7-degree relief. The cutting edge should be honed and the nose of the tool kept under the scale at all times.

If no scale is involved in semi-roughing, the recommendations of carbide manufacturers should be followed regarding the grade of cemented carbide that will provide satisfactory tool life when used from 150 to 200 feet per minute at feeds ranging from 0.010 to 0.020 inch per revolution with a 1/8- to 1/4-inch depth of cut. Successfully designed tools for this operation have a 5- to 7-degree side rake, O-degree back rake, 45-degree side cutting-edge angle, 5-degree end cutting-edge angle, 1/64-inch nose radius, and a 10-degree relief on both side and end.

When finish-turning, boring, or facing, a carbide that will yield an excellent surface finish and good tool life when used at 300 feet per minute should be selected. For such work, a round or triangular insert tool, or a tool with a similar negative side rake is recommended to be used with a feed of 0.005 to 0.010 inch per revolution at a 1/64- to 1/32-inch depth of cut.

Good tool life can be obtained in milling by employing an appropriate grade of cemented carbide. The tool should be capable of operating at a surface speed of 350 feet per minute using a 0.003-inch chip-load per tooth on a climb type face-milling operation. No coolant is recommended. A O-degree rake angle and a 45-degree lead angle with a sharp nose should be used.

When machining commercially pure titanium, the same tools, grades of carbides, feeds, and coolants should be employed. The speeds are approximately double those specified for titanium alloys.

* * *

High altitude military reconnaissance aircraft now in production carry more than 6 tons of electronic equipment and parts.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Hardenable Corrosion-Resistant Alloy for High-Strength Castings

A hardenable corrosion-resistant alloy now produced in cast form for greater design flexibility has been announced by the Donegal Mfg. Co., Marietta, Pa. These castings, known as DC-50, have the same nominal composition as Armco 17-4 PH hardenable stainless alloy. Besides iron it contains 0.05 per cent carbon, 16.5 per cent chromium, 4 per cent nickel, and 4 per cent copper. The corrosion resistance of this alloy is very close to that of the common 18-8 stainless alloys. It is readily machinable in the solution-annealed condition, and when hardened has appreciable ductility and toughness.

In addition to good resistance to sea water, corrosion, and pitting, this alloy is recommended for applications where abrasive or wearing conditions exist, such as ship propellers and pump impellers. Other uses for this casting material are structural high strength parts for use in aircraft and for thrust bearings in all types of applications. The accompanying table gives some physical properties of the alloy.

Physical Properties of DC-50 Casting Alloy

Properties	Condition and Treatment	
	Solution-Treated	Hardened
	1900 Degrees F. for One-Half Hour, Oil-Quenched	850 to 900 Degrees F. for One Hour, Air-Cooled
Tensile strength, thousands of pounds per square inch	135 to 165	180 to 210
Yield strength (2 per cent offset), thousands of pounds per square inch	95 to 125	165 to 200
Elongation in 2 inches, per cent	6 to 15	6 to 15
Hardness		
Rockwell		C40 to 45
Brinell		375 to 440

Water-Mix Cutting Oil Base for Machining and Grinding

The D. A. Stuart Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill., has placed on the market a soluble base oil, called Dasco, that has been specially formulated for metal-cutting and grinding operations. It exhibits stability and resistance to rancidity and can be used to make lean mixtures of oil and water. Mixtures consisting of forty parts of water to one of the base oil are used for milling, drilling, turning, boring, sawing, and reaming. Grinding mixtures prepared in a ratio of 100 to 1 have given good results.

Material for Cold-Metallizing Surfaces with Aluminum

The metallizing of surfaces with aluminum without the use of heat has been announced by Emjay Maintenance Engineers, 327 Union Ave., Rutherford, N. J. A mixture called Kolmetal is used in this metallizing process. The resultant coating, achieved by two applications with a four-hour drying period between them, air-hardens to a plastic-bonded aluminum surface which can be polished, ground, drilled, or bent to a 45-degree angle without chipping or cracking.

The coating has exhibited resistance to atmospheric and sea-water corrosion. It retains its finish and adhesiveness over a wide range of temperatures and demonstrates complete inertness to food, beverage, and liquid products. Besides being used in food processing equipment, it is also employed for the protection of structural iron and steel, ducts and piping, and a variety of industrial equipment and machinery.

Non-Flammable Water-Reducible Enamel Applicable by Spray or Brush

A water-reducible industrial enamel that meets the requirements of the automotive, electrical, and metal-working industries has been made

available by the General Industrial Division of the Sherwin-Williams Co., Cleveland 1, Ohio. Designed for application on metals, the finish is an emulsion type enamel in which water is employed both as an ingredient and a reducing agent. Although it is water-reducible in the application process, the coating is not water-soluble after application. Its glossy finish, which is very hard, has high impact and oil resistance.

This paint, which is not flammable in its liquid form, may be applied by brushing or spraying. After application, it is air-dried for twenty minutes, then baked for approximately eighteen minutes at 300 degrees F. Industrial units already coated with the enamel can be machined or fabricated without damage to either the finish or the cutting tools. At present the paint is available in black only.

Paint-On Protection for Steel and Iron Surfaces

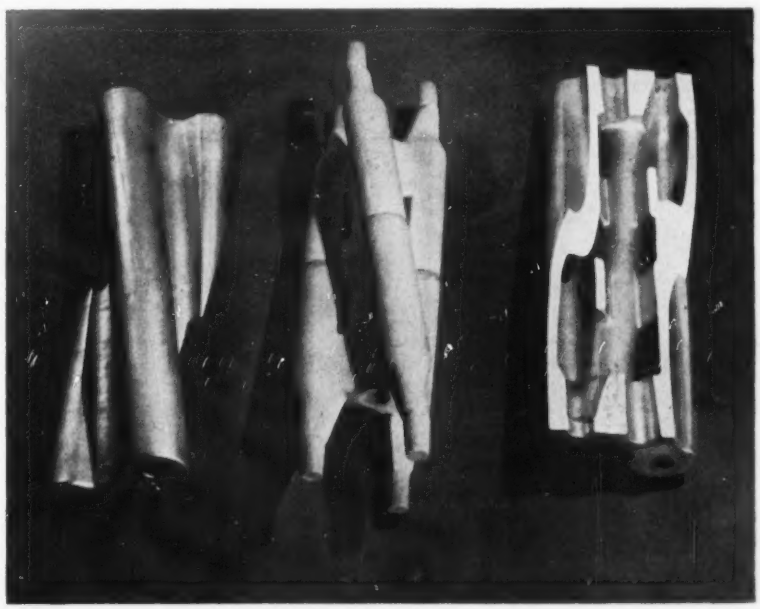
The Sealube Co., Wakefield, Mass., has developed a paint containing 93 to 95 per cent metallic zinc, which is being used to prevent the corrosion of iron and steel surfaces. This paint designated ZRC, employs the principle of anodic protection, by which subsequent scratches on the surface of the treated metal are quickly covered by an adherent film of electro-chemically produced zinc hydroxide. The paint may be applied by brush or spray techniques. It dries to the touch within thirty minutes and is completely hard in four hours. Uses include both new and maintenance protection of structures and equipment in all fields of industry.

Bearing Lubricant for Use Over a Wide Temperature Range

An all-temperature grease, known as Texaco All Temp, has been developed by the Texas Co., 135 E. 42nd St., New York 17, N. Y. This grease possesses the following characteristics: low-temperature operation; shear stability, which prevents leakage at temperatures prevalent in the tropics; high oxidation resistance, which imparts long life; rust and corrosion protection for metal parts; and the capacity to perform even when contaminated with water. Since the grease can be used as a bearing lubricant in a temperature range of from minus 65 degrees F. to plus 125 degrees F., it eliminates the necessity of storing and applying a large variety of greases.

Heat-Treatable Deposit from Aluminum Welding Rods

The availability of aluminum-alloy welding rods in a range of sizes from 1/16 to 1/4 inch for welding Type 356 aluminum has been announced by the All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y. These welding rods, designated All-State No. 356, are used for the reclamation and repair of castings, both at the foundry and the machine shop. They may also be employed to repair castings already in use where replacement parts are not immediately available. The rods are particularly adapted for use where the deposit is to be heat-treated after welding to restore the original physical properties of the base metal. A low shrinkage factor, good corrosion resistance, weldability, and resistance to hot cracking are advantages.



The precision sand core shown in center between sections of an aluminum casting (made by employing a similar core) is prepared by using Bakelite phenolic resins as a sand binder. These resins, produced by the Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York 16, N. Y., help to provide the permanence of form needed to prevent distortion of the precisely molded cores when removed from the core-box. Cores produced by this method are baked in the core-box to the desired strength and rigidity in a few minutes. They withstand the pressure of molten aluminum at 1425 degrees F. long enough to accurately shape the interior of the casting.

Two-Step Broaching Operation Produces 280 Parts per Hour

USING a single-ram broaching machine with a hydraulic indexing fixture, 280 automatic transmission parts are being produced per hour at 85 per cent efficiency. The part is a front oil-pump drive gear for an automatic transmission, and the operation consists of broaching four tangs, 0.340 to 0.350 inch wide from AISI C1117 steel, as shown in Fig. 1. Depth of the four slots broached is 0.431 inch.

Two operations are required to form the four tangs on the 6-ton, 54-inch stroke single-ram broaching machine seen in Fig. 2, made by the Colonial Broach Co., Detroit, Mich. Four parts are broached at a time on a two-sided fixture, one side being loaded and unloaded during the broaching operation on the opposite side.

While two blanks are having their first pair of diametrically opposite tangs broached in the two center positions on the fixture, as illustrated, two others are simultaneously being completed in the two outside positions. To prevent distortion or springing of the tangs during the broaching operation, back-up bars are mounted vertically on the face of the part-holding fixture.

The fixture is then indexed hydraulically 180 degrees, the two outside parts unloaded, the two partially completed gear blanks moved to the outside positions, and the two new blanks placed on the two center work-holders. The unloading of the parts is facilitated by an automatic parts ejector that removes the parts after indexing. To insure that all four tangs are spaced properly 90 degrees apart, hinged locating arms at the outside of the fixture line up the tangs broached in the first operation for the second cut.

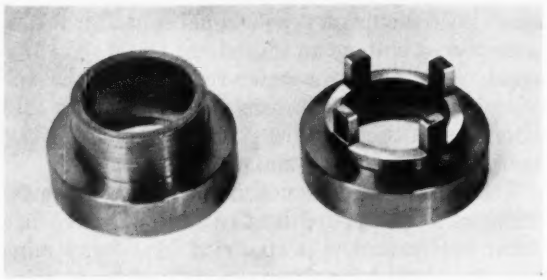


Fig. 1. Blank (left) for front oil-pump gear used in automatic transmission has four tangs broached on single-ram machine shown in Fig. 2.

During the broaching operation, the gear blanks are held in position by means of overhead hydraulic cylinders with equalizers, one cylinder for each two stations. To hold the blank in position while the entire fixture is being indexed, each work-holding stub is machined with a close enough tolerance to keep the blank in position.

* * *

The total expenditures for research and development in the United States were $2,900,000,000 in 1952, compared with $800,000,000 in 1941, according to reports reaching the Chamber of Commerce of the United States.

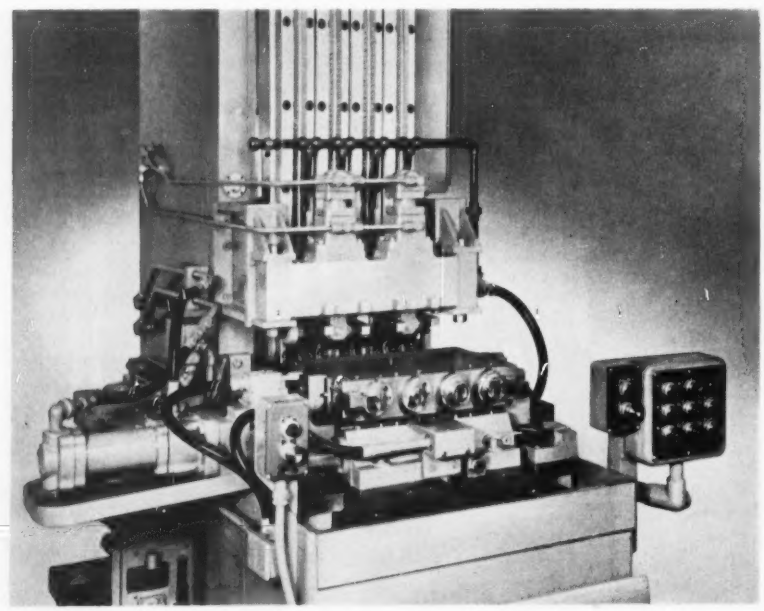


Fig. 2. Single-ram broaching machine with fixture employed for producing automatic transmission parts. Center positions are used for forming the first two tangs, and the two outer positions complete the job.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

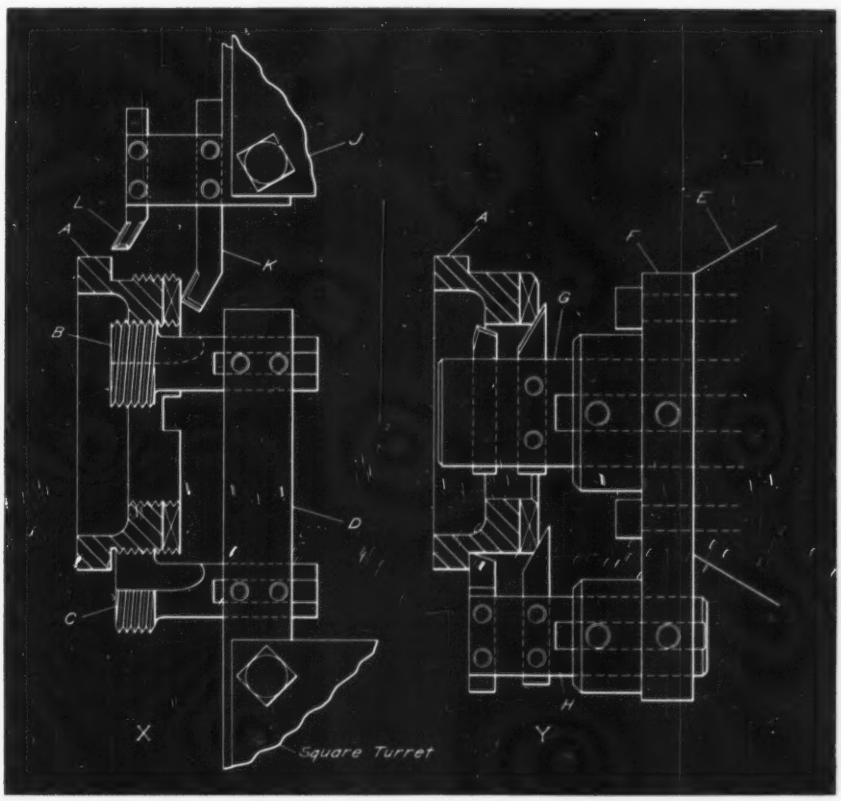
Internal and External Pipe Threads Cut Simultaneously on Lathe

By CLIFFORD T. BOWER, London, England

Pipe threads have one outstanding characteristic in that the same pitch is used for a wide range of thread diameters. It is therefore possible to machine threads on different diameters in one operation—either internal or external threads, or both. Advantage is taken of this characteristic in machining the pipe fitting shown at X in the illustration. The fitting *A* is a brass casting with an external thread 4 inches in diameter and an internal thread 2 5/8 inches in diameter. On both sides of these diameters, 11 threads per inch are required to be cut.

The unmachined, large-diameter flange is gripped in a set of special shallow-step chuck jaws on a turret lathe. The machine happens to be equipped with a lead-screw of the same pitch as the thread to be cut. Two high-speed steel circular chasers with integral plain shanks are used as threading tools. Chaser *B* works with its cutting edge upside down at the back of the bore while the front chaser *C* works in the normal manner on the outside thread diameter. The chasers are so positioned in the holder *D* that both function at the same time. Two passes are sufficient to finish both threads to the desired diameters.

Prior to threading, the component is bored, turned, and chamfered by means of the tools mounted on one face of the hexagon turret *E*, as



Tooling set up for cutting internal and external pipe threads at the same time on a turret lathe, view X; gang of tools set up for turning, boring, and chamfering the pipe fitting before threading, view Y

shown at Y. The tools are attached to a steel plate *F* which is bolted to the turret face. A boss welded to the plate is bored to receive bar *G* which carries a boring tool and a chamfering tool at its outer end. A second tool bar *H* carries an outside turning and chamfering tool. All of the turret tools cut simultaneously.

The turret tools are followed by a pair of facing tools mounted on the rear toolpost *J*, as shown in diagram X. Tool *K* faces the part on the front while tool *L* faces the flange and undercuts the thread end. All of the turning tools are carbide-tipped and operated at a surface speed of 500 feet per minute. The speed is reduced for threading, mainly to give the operator sufficient time to stop the operation before the chaser runs up against the shoulder. The floor-to-floor time for each part is three minutes.

Double-Action Clamping Device

By F. C. ELMO, Dayton, Ohio

The clamping device shown in the illustration is designed with a double-action holding arrangement by means of which pressure can be applied simultaneously on a cylindrical part and on a collar mounted on the part. As illustrated, a shoulder on shaft *A* is forced against a locating surface on a fixture and collar *B* is clamped against a second locating surface.

When the knurled knob *C* is rotated, clamping member *D* is forced against the end of the shaft, as seen in the top view. Member *D* then pivots on its semicircular clamping surface, and transmits force through shaft *E* to the outer member *F*. The latter member is a fork which encloses member *D*. Both members are cross-pinned together by the shaft *E*.

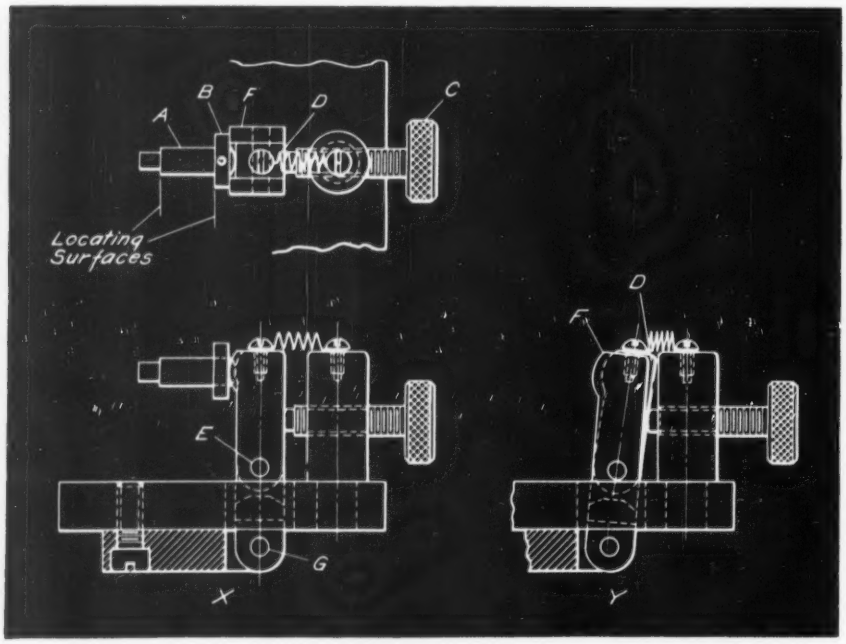
Pivoting on shaft *G*, the outer clamping member straddles the shaft and exerts pressure against the face of the shaft collar at two diametrically opposed points. A tension spring seen at the top of the device returns the clamp assembly to its original setting when the knurled knob is backed off. View Y shows the device in the unclamped setting and view X in the clamped setting. The outline of the inner clamping member is more clearly discernible in view Y.

Versatile V-Block for the Diemaker Holds Unusual Shapes

By W. M. HALLIDAY, Southport, England

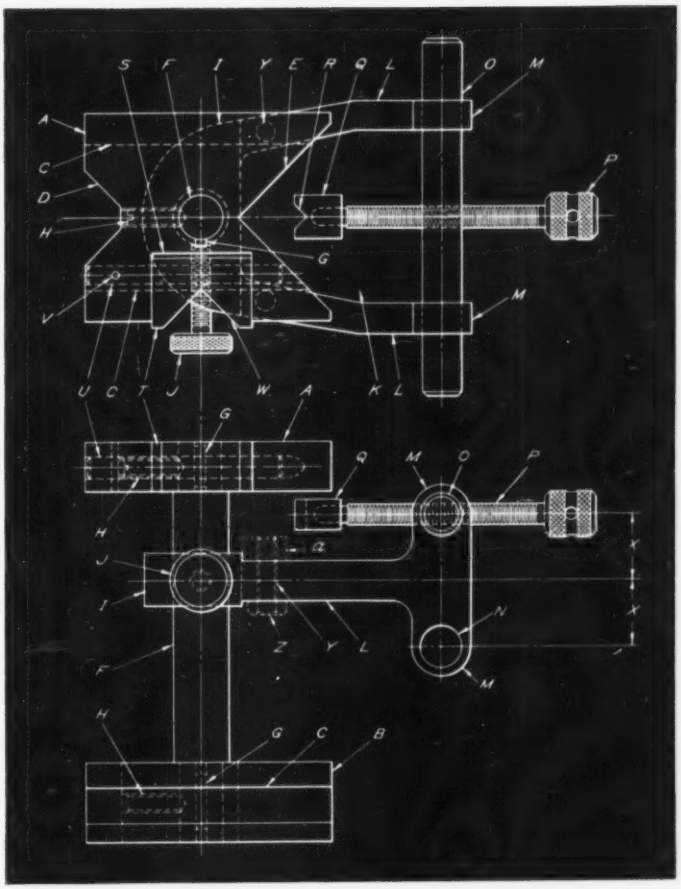
Many unusual shapes and forms of piercing punches, core-plugs, pins, and similar tools or die elements are required in the manufacture and maintenance of press tools, die-casting dies, and molds for plastics. The unusual shapes frequently present holding problems when the parts are being made. A versatile V-block specially adapted for dealing with this kind of work-holding problems is here illustrated. By its use parts of awkward shape can be readily gripped for light grinding or machining.

The clamping arrangements are entirely self-contained in the V-block itself, so that the essen-



Device providing a double clamping action through the use of coupled links

Special V-block and accessories designed to facilitate handling tool and die work that is difficult to hold



tial working parts cannot become mislaid when the block is not in use. Considerable adjustment is afforded by the integral clamping unit in all planes relative to the actual V-slots in the block. This enables the pressure screw to be rapidly set and presented to the work-piece in the best height, radial, or inclined relationship to suit the shape of the part. Work-pieces of very short length can be accommodated that normally cannot be gripped in a standard V-block.

Referring to the diagrams of the V-block, the two hardened and ground steel plates *A* and *B* are identical except that plate *B* is approximately one and one-half times thicker than plate *A*. Extending fully along the length of the two opposed long sides of plate *B* are the wide slots *C*, by means of which the entire V-block may be clamped to the machine table.

In opposite sides of the plates *A* and *B* are the 90-degree V-slots *D* and *E*. Slots *D* at the left are about half the size of slots *E* and permit work-pieces of very small diameter to be accommodated.

To insure exact duplication in the size and shape of these critical V-slots, they should be finish-ground on the inclined sides while both plates are clamped securely together. The outside edges of both plates should also be ground square and to exactly the same over-all dimensions at the same setting.

Both plates *A* and *B* are bored in the center—preferably while they are clamped together for finishing the V-slots—for mounting upon the hardened and ground cylindrical steel column *F*. This column is reduced in diameter a small amount at each end to provide positive shoulders for the accurate location of the two plates. These plates are secured by means of Woodruff keys *G* and headless screws *H*.

The plates are accurately mounted on the column so that the respective V-slots will be exactly in line, as shown in the upper diagram. Bored to be a free sliding fit upon the middle portion of the column is a mild steel plate *I*. This plate is drilled and tapped in one side wall for the brass locking screw *J*, which bears directly upon the side of the column. Plate *I* is machined with a wide slot *K* forming identical, parallel fork limbs *L*, of the same length, as shown in the upper view of the illustration.

The fork limbs *L* are made T-shaped to form the extended lugs *M*. These lugs are cross-drilled in exact alignment to provide two pairs of bearing holes *N* for the hardened and ground steel rod *O*, which is a free revolving fit. The rod is interchangeable in the upper and lower holes.

Rod *O* is drilled and tapped diametrically to receive the long pressure screw *P*, and is of sufficient over-all length to prevent it from passing completely out of either bearing hole *N* when the pressure screw is in contact with the inside wall of either limb *L*. Thus rod *O* cannot be withdrawn from its bearing holes until screw *P* is removed.

The center height *X* of the respective pairs of holes N should be about one and one-half times the thickness of the V-slotted plate *A*. This insures that the center of screw *P*, when in the horizontal plane as shown, will coincide with the top edge of plate *A*, when the top surface of plate *I* is in contact with the under side of the former member.

The threaded shank of screw *P* should be long enough to pass almost to the bottom of the largest V-slot *E*. The tip of the screw is reduced in diameter for a short distance and is rounded at the end to provide a plain bearing for the auxiliary clamping pad *Q*. This member is of case-hardened mild steel and is bored to be a slip-on fit over the bearing at the end of screw *P* on which it is free to revolve. The bottom of the hole is also rounded to suit the tip of the screw. In the opposite side of the pad is the small 90-degree V-slot *R* which is accurately centered with the axis of screw *P*.

A separate swiveling pad will be found extremely useful for simplifying and safeguarding the gripping of punches or core-plugs having square, rectangular, or polygonal shanks. Use of such an auxiliary pad will prevent the tip of the screw from bearing directly against some corner of the work, thus enabling a more powerful grip to be obtained without damage to the work.

In the long side of plate *A* is machined a deep parallel-sided slot *S* which is centrally located relative to the longitudinal axis of column *F*. Closely fitted in the slot is a hardened and ground rectangular steel plate *T*. Plate *A* is fulcrum-mounted on pin *U* which is retained in the plate by cross-pin *V*. Mounted in this way, plate *T* has a swiveling movement of approximately 25 degrees relative to the V-slotted member in which it is housed.

In plate *T* is a 90-degree V-slot *W* located centrally with the axis of column *F*. Two clearance holes *Y* are drilled through the fork limbs *L* for set-screws *Z* required for fastening the rectangular stop-plate *a* to the top of the respective limbs in the manner indicated by light dotted lines in the lower view. This stop-plate should be of hardened steel and ground flat and parallel on the top and bottom surfaces. Its purpose is to act as a positive stop when a number of identical components have to be successively mounted at exactly the same height in one or other of the V-slots in member *A*.

From the illustrations it will be seen that the clamping plate *I* can be moved up along the column *F* or swiveled radially on the column through a full 360 degrees. Similarly, the pressure screw *P* can be set central with any of the three V-slots in plate *A*. By moving rod *O* laterally through the bearings *N*, the pressure screw can be substantially offset with respect to the center of any of the three vees.

Furthermore, the pressure screw can be instantly set at any inclination both above or below the horizontal center axis of the fixture by swiveling rod *O* in its bearing. The pressure screw and rod may be changed to the lower bearing hole *N* to hold long components in the vees of the bottom plate *B*.

Thus it will be noted that almost universal movement and adjustment facilities are available for setting the pressure screw *P* relative to the work-piece resting in the V-slotted plates. The large-size opening *K* in the clamping plate also insures freedom from interference with large-diameter work-pieces which may project a considerable distance below the top V-plate *A*.

When gripping punches or plugs having conical shanks, the clamping arm *I* will be swiveled 90 degrees from the position illustrated so as to bring the pressure screw adjacent to and central with the V-slot *W* in the small plate *T*. The work will be rested in this V-slot and, as the pressure screw is adjusted to grip the part, plate *T* will be automatically swiveled in member *A* to suit the angle of taper on the sides of the component.

A number of auxiliary clamping pads *Q* can be provided, each having its end face formed in a different manner to suit the shape of the work. All component parts of the fixture should be hardened and ground and fitted together within precision limits to obtain fine accuracy and long life.

* * *

Colorless Oxide Coating for Aluminum and Aluminum Alloys

Substantially colorless oxide coatings can be produced on aluminum and its alloys by means of the "Anonizing" process, developed by the Colonial Alloys Co., Philadelphia, Pa. Production of this coating involves three steps—cleaning the work, immersing it in an Anonizing solution, and rinsing.

The work should first be cleaned by immersion in a hot solution of a mild inhibited alkaline cleaner. If excessive deposits of oil or grease are present, the alkaline dip should be preceded by vapor degreasing or by solvent emulsion cleaning of the work.

The cleaned metal is next immersed for a period of approximately ten minutes in the hot Anonizing solution. Immersion for a few seconds in this solution will, however, suffice if the treatment is intended as a base for subsequent organic finishes. The parts are then thoroughly rinsed in clear, flowing water.

Depending on the alloy and its initial surface preparation, clear protective coatings are formed by this finishing method which have good corrosion resistance and increased abrasion resistance. The appearance of the film is somewhat similar to that produced by the sulphuric acid anodizing process.

INGENIOUS *Mechanisms*

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Pressure Governor for Handwheel of Lathe Tailstock

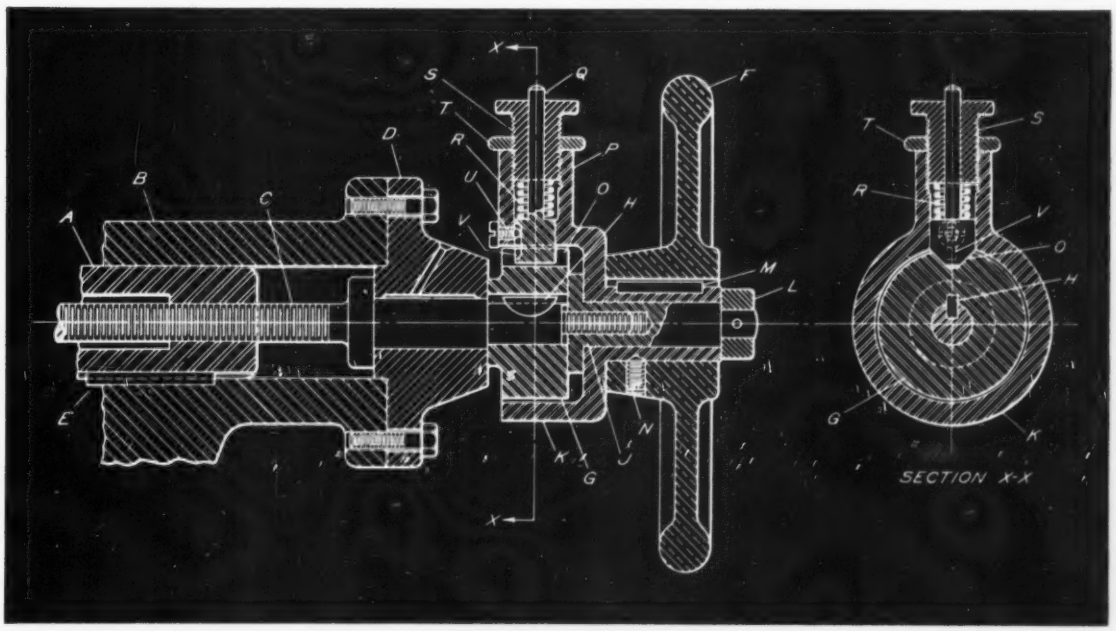
By WILLIAM MORSON, Birkdale, England

The danger of exerting excessive axial pressure when adjusting a lathe tailstock for a "between centers" operation can be averted with the governor illustrated. It can also be used to advantage where a small drill or reamer must be supported in a relatively large tailstock—increasing the sensitivity of the feed and thus reducing tool breakage. The device is of simple construction and retains all the standard parts of the tailstock.

In the drawing, which shows the right-hand end of the tailstock, the spindle *A* is a sliding fit in the casting *B*. The end of the spindle forms a nut which engages the feed-screw *C* rotating in the cap *D*. A key *E* holds the spindle from turning as it is advanced or retracted. The handwheel *F* is removed from its normal position near the end of the feed-screw and replaced by a cast-steel disc *G*, feathered to the feed-screw by an existing Woodruff key *H*. Engaged to the threaded end of the screw is a shouldered shaft *J* which serves to keep the disc in a correct endwise position whenever the tailstock handwheel is being rotated.

A revolving flanged sleeve *K* has a clearance fit over the disc, the right-hand end of the sleeve forming a stem which is a close fit over shaft *J*. A correct endwise position of the sleeve, in turn, is maintained by a collar *L* cross-pinned to the end of the shaft. Fixed to the outside diameter of the sleeve stem by a key *M* and a set-screw *N* is the handwheel *F*.

At a point across its periphery, the disc has a 90-degree V-notch *O* cut radially. A bossed section *P* of the sleeve contains a detent plunger *Q*. This plunger is kept in position in the V-notch by a spring *R*. During normal operation, handwheel *F*, sleeve *K*, disc *G*, and feed-screw *C* turn as a unit.



Transmitting the drive from the handwheel (F) to the feed-screw (C) through a detent plunger (Q) limits the axial pressure that can be exerted.

Should, however, the advance of the spindle require excessive axial pressure to be applied by the handwheel, the rotation of the disc and the feed-screw will be arrested as the detent plunger rides out of the V-notch. Thus, if a revolving center is supported from the tailstock spindle, the handwheel advances the spindle until the center engages the conical opening in the end of the work. Further advance is resisted by the center, and the detent plunger automatically rides out of the V-notch.

The load that the detent plunger can carry before it will disengage is adjustable through the vertical setting of a bushing *S* threaded to the inside of the bossed section. A lock-nut *T* serves to maintain the setting. For a revolving center, the mechanism is set at a point that is well below the safe loading on the balls and races, but will permit proper support for the work. This point is readily established by testing the revolving center for free rotation under load.

When the detent plunger is disengaged, its alignment with the V-notch is maintained by a set-screw *U* engaging slot *V* in the plunger. Should it be desired to operate the handwheel without the regulating action of the governor, the bushing *S* can be lowered to fully compress the spring *R*.

Gears in Transmission Line Increase Shaft Oscillation

By L. KASPER, Philadelphia, Pa.

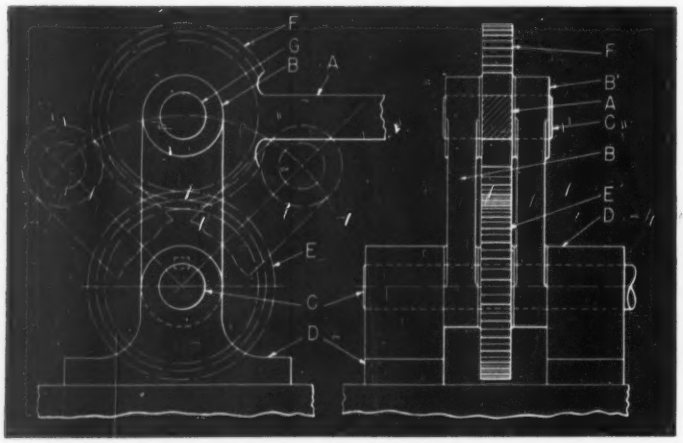
A shaft in a machine fabricating a wire product oscillated continuously on its axis—running 90 degrees in one direction, then 90 degrees in an opposite direction. The movement of the shaft was transmitted from an eccentric through a connecting-rod and link. Subsequently, because of a design change in the product, it became necessary to double the oscillation of the shaft. Space limitations prevented any increase in the throw of the eccentric, and to extend the swing of the link to 180 degrees would have created a dead-center condition that would have rendered the mechanism inoperable. The drawing shows how the problem was solved by introducing gears into the line of transmission.

Originally, the connecting-rod *A* was pinned to the single link *B*, the lower end of which was keyed to the shaft *C* supported by bearings *D*. (The link is shown in solid outline at the mid-point of its movement, and in broken lines at the two extremities of its movement.) In the altered mechanism, two links *B* and *B'* swing freely on the shaft, and straddle a gear *E* keyed to the shaft. Welded to the end of the connecting-rod is a second gear *F*, meshing with gear *E* and free on stud *G*.

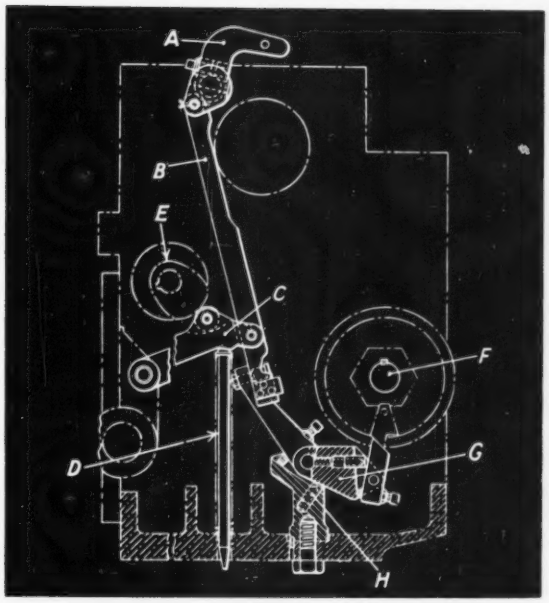
In operation, the connecting-rod transmits movement to the links, running 90 degrees, as in the original mechanism. However, the action of gear *F* in rotating around gear *E* causes shaft *C* to oscillate the increased amount that is desired. The reason for the increase is that the change in position of gear *F*, fixed to the connecting-rod, creates a compensating movement of gear *E* with which it meshes. Both gears are identical in size. Actually, since gear *F* does not rotate completely around gear *E*, gear segments instead of complete gears would serve the purpose. Being stock items, the gears are more practical to use.

Swing Stop for Automatic Lathe

A unique mechanism for operating a swing stop on an automatic lathe is shown in the illustration. This mechanism permits the stop to be swung to a position in front of the headstock spindle to control the axial feed of the bar stock



Routing the drive through two gears doubles the degree of oscillation of the shaft.



Mechanism for operating swing stop (A) on an automatic lathe to control axial feed of bar stock

at the beginning of the automatic cycle. Thereafter, the stop is held clear of the work, and at a predetermined point in the cutting cycle, a mechanism (not shown) is operated to impart a second feed movement to the stock.

The swing stop *A* is secured to one end of a shaft which can swivel in a bearing in the headstock. The opposite end of this shaft carries an arm that is connected by link *B* to the follower arm *C*, the latter being pivoted at its left-hand end on a pin fitted to the frame. Downward movement of the stop *A* is imparted by a compression spring *D* surrounding a pin, the upper end of which makes contact with the arm *C*. The lower end of this pin passes through a hole in the frame. Upon completion of the initial feed of the bar stock, stop *A* is swung upward by cam *E*, which is engaged by a roller on arm *C*.

The shaft on which cam *E* is mounted operates the mechanism whereby the stock is fed through the collet, and is driven intermittently from the back-shaft of the lathe, through a one-revolution-and-stop clutch (not shown). With this arrangement, the cam *E* is rotated through two revolutions while the continuously driven front camshaft *F*, which controls the turret and cross-line motions, makes one complete revolution during each cutting cycle.

When the stock is to be fed a second time, a trip-dog, attached to a disc on the camshaft *F*, engages a spring-loaded pawl fitted to the right-hand end of the bellcrank lever *G*. The lever, which is carried on a forked bracket secured to the frame, swivels in a clockwise direction against the action of the spring-loaded plunger *H*. As a result, a stepped pin fitted to the left-hand end of lever *G* is swung to a position above an angle bracket attached to the lower end of link *B*, so that movement of the link and of stop *A* is prevented. Simultaneously, the shaft carrying cam *E* is rotated, causing the stock to be fed.

If desired, the shaft carrying cam *E* can be caused to make more than two complete revolutions during each cutting cycle, to enable a corresponding number of axial feed motions to be applied to the bar stock. Trip-dogs, numbering one less than the number of feed motions desired, are then fitted to the disc on camshaft *F* to prevent motion of stop *A* during machining.

A 2-inch diameter saw attached to a drill press adapter is saving Convair's San Diego division approximately $8000 annually. The device is used for the trimming of bulkheads, frames, angles, and extruded parts, which was formerly done on a table saw, band saw, or by the use of hand snips. Height of the flange can be easily controlled by adjusting the table.

The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

The Cost of Making Orders

THE remark "Selling efficiency hasn't kept pace with production efficiency" is a fairly common complaint of industrial leaders who are currently pointing a critical finger at sales records. One reason that selling has not increased in efficiency as much as fabricating a steel shape is because the metal part does not have ideas. It just waits for the hands of the mechanic and for the machine. It has no opinions, convictions, or emotions. Conversely, prospects are people; they differ widely in these respects and are slow to change.

A recent survey was made by the Sales Executive Club of New York on the cost of producing an order. A total of 228 replies were received from manufacturers of industrial equipment, including machine tools, small tools, and plant supplies. The average estimated cost of making one call was $17.24. The cost per call made by the machine-tool engineer greatly exceeds that of the salesman of industrial supplies.

As the clock ticks on—whether we are traveling, waiting, or facing prospects—the dollar cost of selling piles up. We are not operators before a conveyor belt or tending a machine that schedules our time. For the most part we are masters of the "where, when, who, what, and how long." It has been said the engineer has developed a perfect clock, but often falls down in its wise use. To a large extent we determine the utility of clock-ticking minutes. Given good equipment to sell, sales tools, and headquarters' service, the rest is pretty much up to us.

In our own selling we meet a great variety of personalities and technical problems. Methods and timing constantly differ. Efficiency results from judgment and skill in molding opinion and implementing decision.

Certain principles and rules hold true that have an enormous bearing upon the cost of the call and our working efficiency. By sketching a few of these we can check our own actions. When we look back, instances when we lost time and missed opportunities repeatedly come to mind.

Lessons in properly allotting our time can be had from observation of efficient production in the shop.

1. Products are efficiently made by exact advance scheduling to meet a shipping date.

In selling, we cannot time the manufacture of an order, but we can schedule the work of each day or week and leave a little excess time for unforeseen events. Successful salesmen do this. Almost anyone can point to some sales engineer of perhaps inferior ability who in the long run sells more than we do because he carefully allocates his time.

2. In the orderly shop each operation is timed.

Again, we cannot exactly do this, because we don't know how long Jake Andrews (the shop superintendent we call on) may want to talk. But probably we can schedule our time more advantageously than we do, see all the "Jake Andrews" who influence purchases, and arrange a better sequence for interviews.

3. Efficient shop practice does not tolerate poor materials and working tools.

Do we have the best selling tools? Are price and delivery data complete? Is the information presented in a way to conserve our time? If not, do we demand that our sales manager equip us properly to sell efficiently?

4. Modern production avoids "waiting time."

Waiting time can be made selling time and yet we often see salesmen conning home type magazines and comics in reception offices. Every salesman can devise new selling ideas relating to product and procedure while waiting, or at least rehearse his sales tactics. Our knowledge of a prospect can also often be increased by en-

gaging in conversation with a chance acquaintance in the reception room.

5. Economical production depends on performing various operations at one time.

We can drive on a less frequented highway or walk several blocks and still think about business. The experienced salesman with a practiced mind thinks ahead and plans, while his subconscious self attends to the ordinary details of procedure.

6. Successful shop production depends upon accurate records.

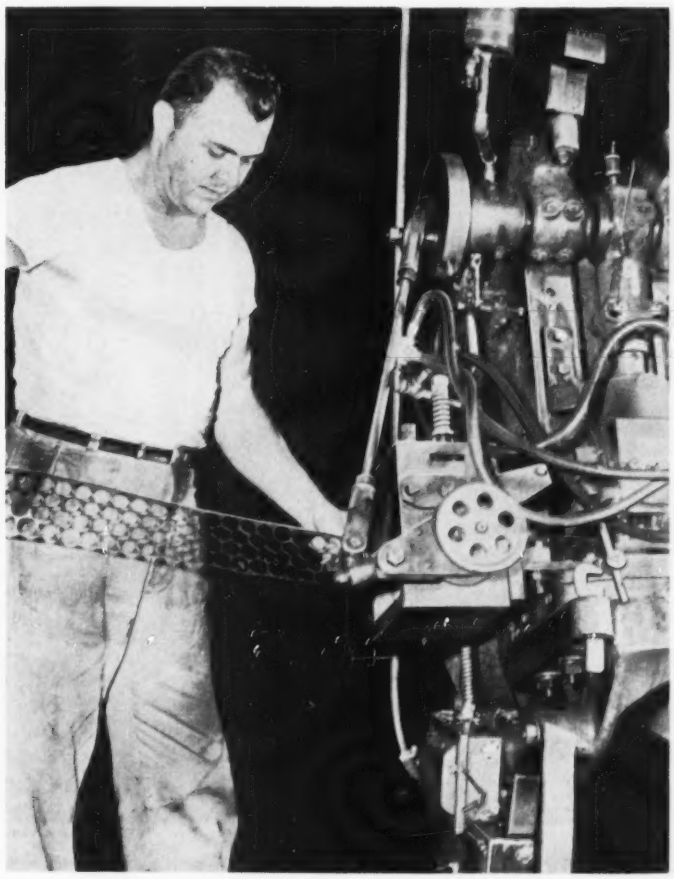
Frequently we lose time because we do not get the name of the man interviewed and must later call up to find out. Or we did not make note of a dimension while it was fresh in our mind, or get the complete operating schedule required. "Folding back" is a big cause for lost time and can be avoided by being attentive to details.

Your reaction to all this may be: "So he expects the sales engineer to think business from dawn to midnight." Not at all. The key in selling is to learn how to time the separation between work and relaxation.

Carbide Inserts Increase Life of Socket Heads

Casehardened, self-tapping screws create a problem with power-driven socket heads. Rapid wearing of the sockets results in a great deal of "down" time for wrench changing, especially on production lines where many power wrenches are employed.

With the help of cemented carbides, the Carboloy Department of General Electric Co., Detroit, Mich., alleviated this condition. Cemented-carbide inserts brazed in the power-driven socket heads provided the answer. In one test application, the new type sockets were operated constantly during a three-year period with no visible signs of wear. It is claimed that these sockets tipped with carbide are practically indestructible on many applications. They can be used on all types of power or hand tools. The new type sockets are now available in 1/4- and 3/8-inch square drives with hexagonal openings ranging from 1/4 to 7/16 inch, and from 5/16 to 1/2 inch, respectively.



Punching button backs from pre-coated coil stock at the Jarco Metal Products Corporation, Westbury, N. Y. Production was doubled by installing automatic feeds on the company's six presses and converting to coil stock. Previously, flat sheets were used. One worker can now tend all six presses. Die life has been extended and scrap loss reduced. The pre-coated coils are furnished by the Enamelstrip Corporation, Allentown, Pa.

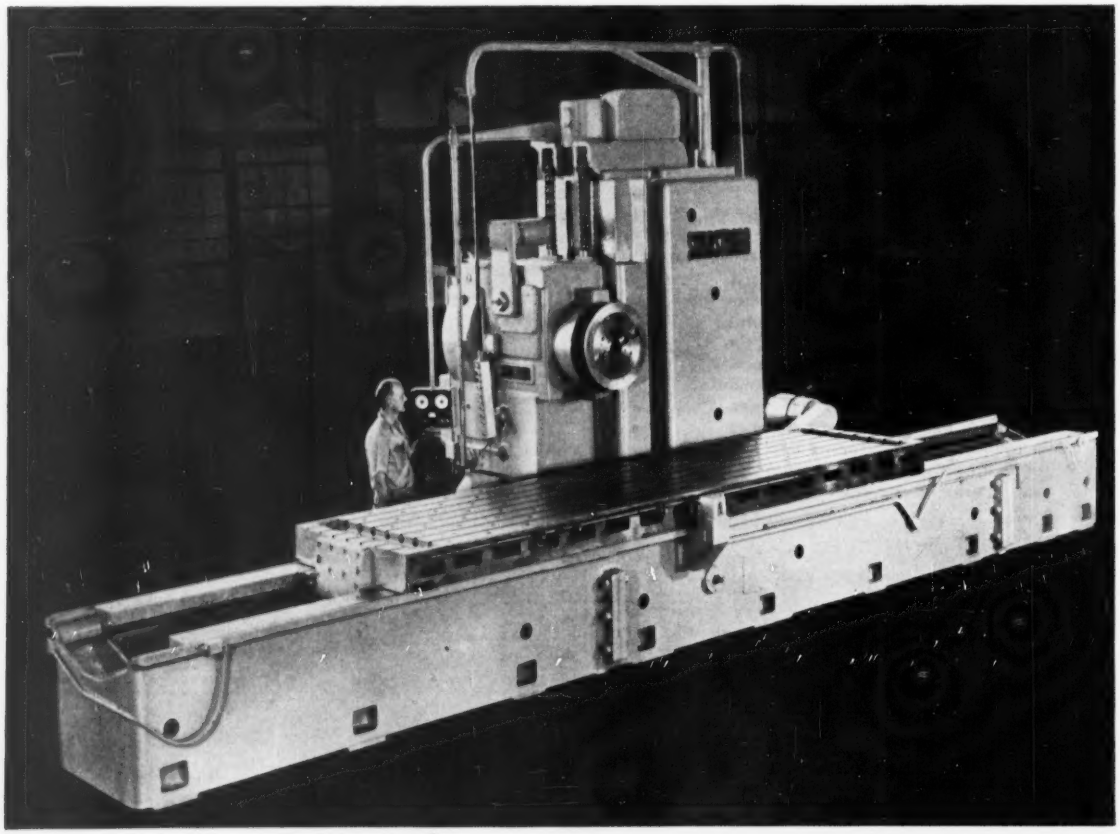
LATEST DEVELOPMENTS IN *Shop*

Sundstrand Heavy-Duty "Rigidmil"

The Sundstrand Machine Tool Co., Dept. M, 2530 Eleventh St., Rockford, Ill., has designed and built a large size "Rigidmil" for heavy work, such as milling large die-blocks from the rough prior to cutting the impression or die cavity and for removing the old impressions from used die-blocks before recutting. This Model 77 "Rigidmil" has a vertical power feed for the head that can be used in combination with the longitudinal power table feed for automatic square-cycle milling of die shanks. A scale attached to the vertical head and an adjustable pointer on the bed are provided for setting up the automatic cycle or manually operating the machine.

The standard machine has a table 48 inches wide and can be furnished with feed strokes of 144, 168, 192, or 216 inches. A variable-feed drive is provided for both longitudinal movement of the table and vertical movement of the head. Meters incorporated in the pendent control unit indicate the rate of feed in inches per minute.

The spindle head is of the horizontal type and has either a 60-, 75-, or 100-H.P. motor. A meter on the control panel indicates the per cent of full load current on the spindle motor. Speed changes are made by means of pick-off change-gears. A variable-speed drive for the spindle head can be furnished.



Heavy-duty "Rigidmil" built by the Sundstrand Machine Tool Co.

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

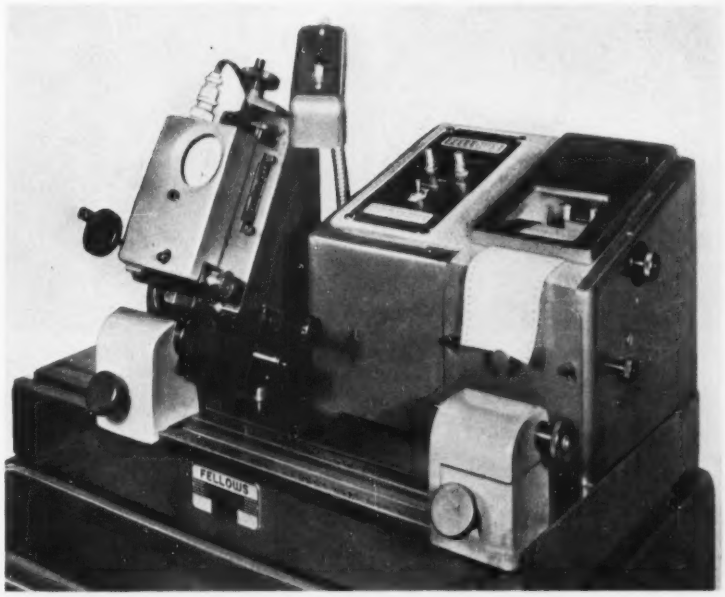
Fellows "Red Liner" Instrument for Checking Fine-Pitch Gears

A "Red Liner" instrument for checking fine-pitch gears has been developed by the Fellows Gear Shaper Co., Dept. M., Springfield, Vt. This instrument is designed to provide the type of measurement designated by the A.G.M.A. as a "composite check," which requires the combined measuring of all gear errors. Errors in gear tooth elements cause changes in velocity or in center distance, and the latter principle is the basis upon which the fine-pitch "Red Liner" operates.

The master gear is mounted on an arbor in a movable spring-loaded carrier and can be rotated either by a handwheel or by motor. It meshes, without backlash, with the work which is located in a fixed holder or on fixed centers. As master and work rotate in close contact, any variation in center distance is measured and recorded on a constantly moving paper chart. The center-distance variations are detected by an electrical sensing device whose output signal is amplified to operate an electrical recorder. By means of an easy adjustment the amplification can be made 200 to 1, 400 to 1, or 800 to 1.

When motor driven, the speed of rotation of the master gear can be varied, so that tooth velocity will be maintained at the best operating condition. The charting paper roll is also driven by the motor, and the rate of paper travel can be set for 5 or 10 inches per revolution of the master. The pressure between the master gear and work is adjustable to conform with the A.G.M.A. standards for measuring fine-pitch gears.

The instrument can be furnished in a bench model or with a cabinet. Headstock and tailstock centers and a 1/10,000-inch dial indicator for visual inspection without a chart are furnished as standard equipment. The headstock center is held in a vee and can be replaced by a stationary arbor when desired. A turret type fixture for holding several different designs of gears and pinions under 1/2 inch in diameter, is also available. The instrument will measure external or internal gear teeth of 20 pitch and finer up to a pitch diameter of 4 inches.

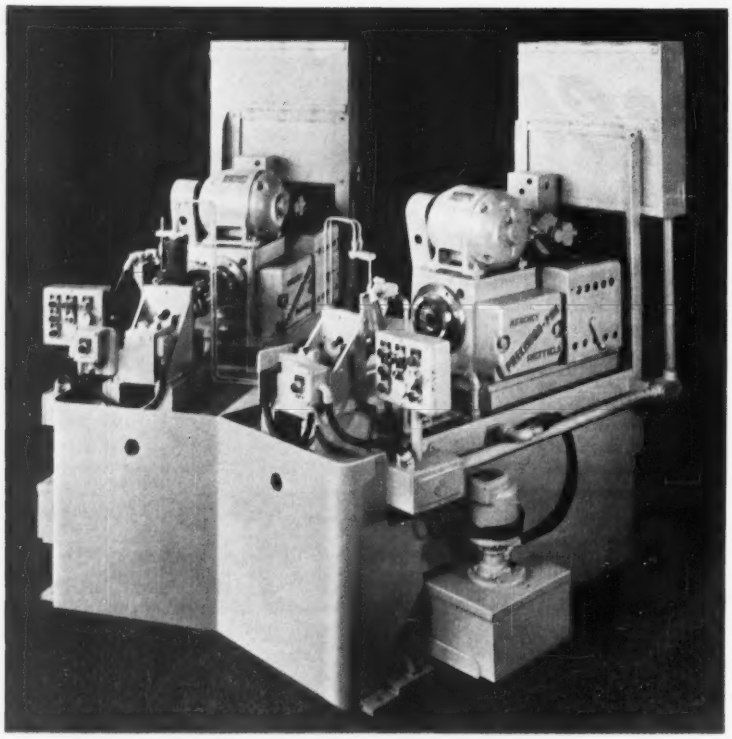


"Red Liner" instrument for checking fine-pitch gears

Airco Electrode for Welding Mild Steel at High Speed

A new type welding electrode known as Airco "Easyarc 12," which is said to be capable of welding mild steel at double the speeds obtained with conventional electrodes, has just been announced by the Air Reduction Sales Co., Dept. M, 60 E. 42nd St., New York 17, N. Y. The tremendous increase in welding speed is obtained through the addition of a large amount of powdered metal to the electrode coating. The powdered metal changes the arc action so that welds can be made by dragging the electrode in contact with the plate. Because the metal powder becomes part of the weld bead, faster welding is achieved in the fabrication of products from mild steel plate and rolled sections.

Weld spatter is decreased when using the new electrode to less than half that obtained with regular electrodes. The weld beads are said to be exceptionally smooth and the weld metal of high strength and good ductility.

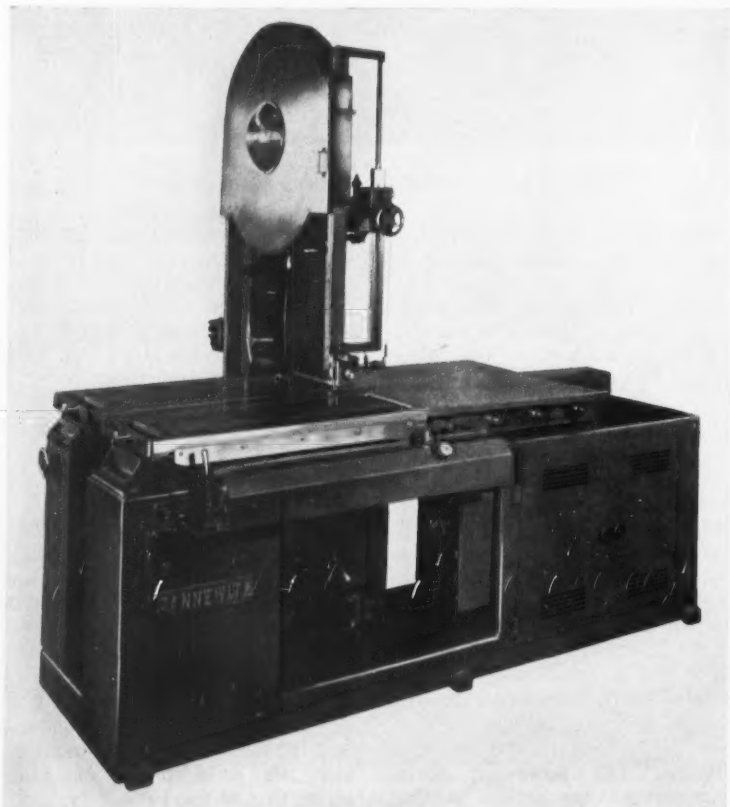


Special machine for threading transmission shafts, developed by the Murchey Division, Sheffield Corporation

Machine for Threading Transmission Shafts

A special machine for threading main transmission shafts with a 7/8-16 thread or 11/32 inch long, at the rate of 400 parts per hour, is a recent development of the Murchey Division, Sheffield Corporation, Dept. M, Dayton 1, Ohio. Two automatic cycling "Precision-Pak" self-contained threading units with precision lead-screws that provide smooth, accurate spindle travel are incorporated in this machine. The units are mounted on a specially constructed double-welded base complete with built-in coolant pumps. They are positioned at an angle of approximately 45 degrees so that both can be operated at one time. An air-operated collet type fixture in line with each threading unit is used to hold the part during threading.

When the machine is in use, the operator picks up a part in each hand, inserts them in the collets and presses the starter button on each unit. As soon as the automatic threading cycle is complete, the parts are automatically released for unloading. Each "Precision-Pak" unit has an internal threading capacity ranging from 1 1/8 to 4 inches and an external capacity from 3/4 inch to 3 1/2 inches. It will generate threads up to a maximum of 8 pitch. The spindle travel range is from 1/2 inch to 4 inches, and the spindle speeds range from 38 to 346 R.P.M. in increments of approximately 15 R.P.M.



Tannewitz variable-speed band saw with hydraulically actuated table

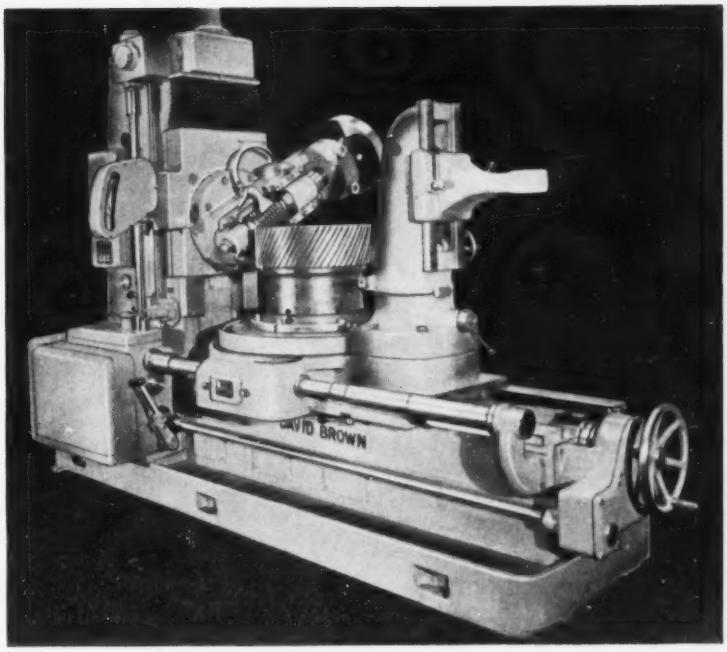
Band Saw with Power Actuated Table

For metal-cutting operations on work that is too large or cumbersome to be readily fed by hand, the Tannewitz Works, Dept. M, Grand Rapids, Mich., is now producing variable-speed band saws equipped with hydraulically actuated tables. The machine shown is a standard size 36-inch band saw with a 36- by 37-inch table having a hydraulic feed of 0 to 6 inches per second.

Rapid traverse of the table to the point of contact between work and saw is provided to obtain maximum production. Machines of this type can be produced in practically any size to suit specific needs.

Moving-Table Type Hobbing Machine

A David Brown MT 60 moving-table type hobbing machine is being introduced in the United States by the Morey Machinery Co., Inc., Dept. M, 383 Lafayette St., New York 3, N.Y. Equipment available for this universal machine permits cutting spur, helical, spiral, and worm gears, as well as spline-shafts, within its size capacity range. It will produce gears having a maximum circular pitch of 1 1/2 inches. Hobs up to 8 inches in diameter and 10 inches long can be used. The maximum center distance between hob and work is 36 inches and the minimum distance 3 1/2 inches. Hob speeds range from 21 to 107 R.P.M. The machine uses a 10-H.P. motor and is designed for conventional and climb-hobbing.



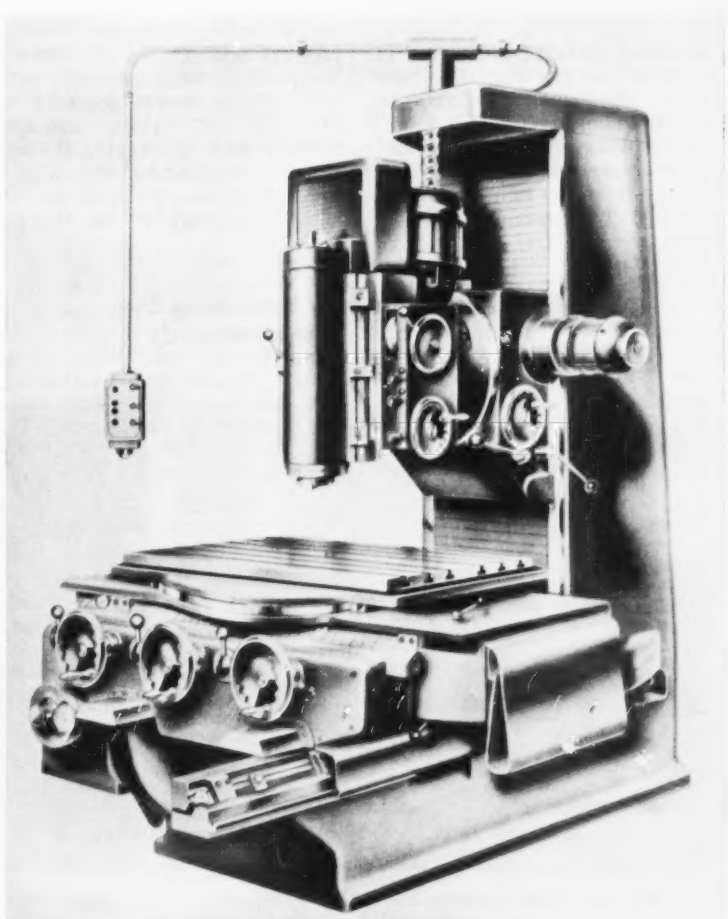
Hobbing machine introduced in this country by Morey Machinery Co. Inc.

Universal Boring and Milling Machine

A swiveling column, similar to that of a radial drill, which can be turned 180 degrees horizontally in either direction is combined with a large work-table in a Bokoe No. 3 universal boring and milling machine introduced in this country by the Kurt Orban Co., Inc., Dept. M, 205 E. 42nd St., New York 17, N. Y. This 7 1/2-ton machine will handle work-pieces up to 8 feet 2 inches in diameter.

The milling head on the column swivels vertically 90 degrees in either direction, and the table feeds are infinitely variable in longitudinal, transverse, and rotary directions. Automatic controls on the work-table provide for a transverse movement of 28 inches and a longitudinal movement of 55 inches with infinitely variable table feeds from 0.4 inch to 39 inches per minute. Power feed for circular movement, infinitely variable from 0.7 inch to 70 inches per minute, permits continuous circular milling operations. The table can be rotated 360 degrees by power or hand feed. Scales and verniers for table movements and the milling carriage are arranged for the use of gage-blocks in the production of tools, dies, and fixtures.

Milling slide movements with six mechanical feeds and rapid



Universal boring and milling machine introduced by Kurt Orban Co. Inc.

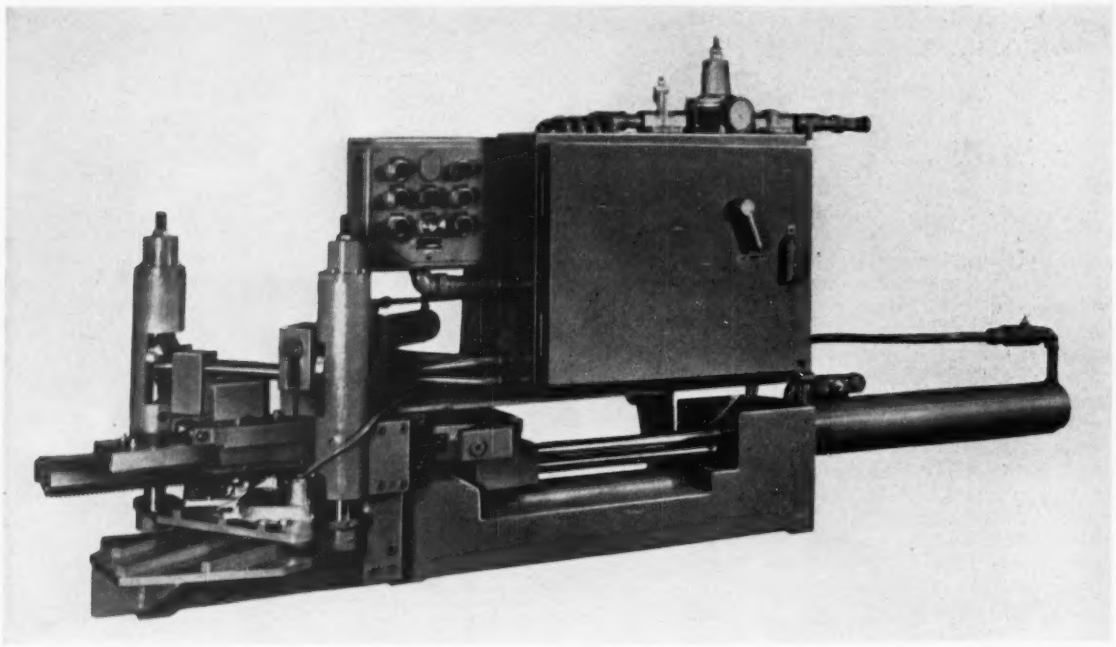


Fig. 1. Air-powered broaching fixture made by National Broach & Machine Co., which simultaneously broaches two non-parallel slots in a die-cast aluminum gear housing.

travel, allow drilling and boring operations up to 11 7/8 inches in diameter and the use of milling cutters up to approximately 10 inches in diameter.

With a supplementary power-driven rotary side table, large patterns up to 31 feet in diameter can be milled. The depth of throat between column slide and spindle center is 37 1/2 inches. A wide range of settings and adjustments is provided, with infinitely variable spindle speeds from 36 to 1800 R.P.M. Speeds can be changed without stopping the machine. In addition to vertical milling and boring, the machine can also be equipped for use as a radial drill.

Air-Powered Fixture for Broaching Two Non-Parallel Slots Simultaneously

An air-powered horizontal broaching fixture has been built by the National Broach & Machine Co Dept. M, 5600 St. Jean Ave., Detroit 13, Mich., which simultaneously broaches two non-parallel slots in a die-cast aluminum washing machine gear-case cover. The 1/8- by 1/8-inch slots are provided in the part to guide control bars and are located at an angle of 10- degrees to each other. With the new broaching equipment shown in Fig. 1 only eight seconds is required for the complete operation of loading, broaching, and unloading the part.

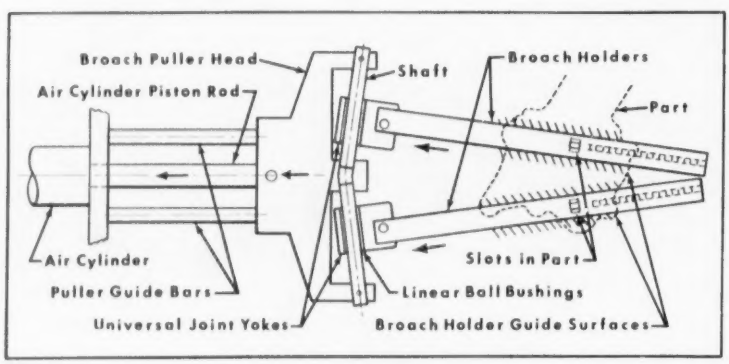
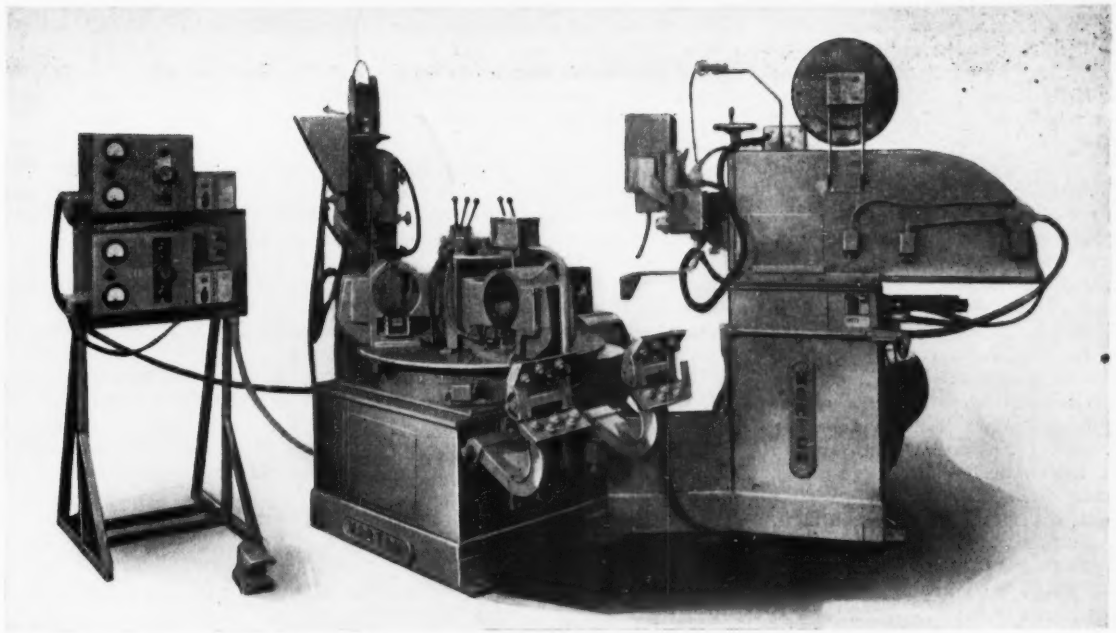


Fig. 2. Diagrammatic view of fixture shown in Fig. 1 illustrating operating principle of non-parallel broach puller

Simultaneous broaching of the non-parallel slots is made possible by a broach puller in which each broach is attached to individual angularly mounted shafts on the puller head through universal-joint type yokes, as shown diagrammatically in Fig. 2. The yokes are mounted on their shafts with linear ball bushings which permit them to move sideways freely in relation to each other.

The broaches are mounted in holders that are guided in slides above the part. Thus, as the broaches are pulled through the angular slots, they are guided in the correct angular paths and the yoke members mounted on the puller head can spread apart on the cutting stroke and move toward each other on the broach-return stroke.

An air cylinder 2 inches in diameter raises the platform carrying the work, and another air cylinder 4 inches in diameter pulls the broaches through the part. The fixture is approximately 7 feet long, 3 feet high, and 2 feet wide, and the total weight is about 800 pounds.



Automatic bearing-shell welding machine introduced by the Morton Mfg. Co.

Morton Special Machine for Welding Bearing Shells

Both internal and external welds can be made in bearing shells having heavy walls by a special automatic welding machine announced by the Morton Mfg. Co., Dept. M, Broadway and Hoyt, Muskegon Heights, Mich. A manually controlled air-operated flux back-up unit is built into the clamping fixtures which are employed for internal welding.

The completely automatic operating and indexing cycles of either or both head slides are under the operators control. These cycles include rapid traverse, variable controlled speed during welding, and rapid retraction. The table is indexed into three positions against fixed adjustable stops by hydraulic power. The indexing and welding motions are electrically interlocked for protection against incorrect sequencing.

Manual, air-operated type cast bronze clamp shoes hold the work at each of the three stations. Other features include automatic light-beam gaging of the shell seam and automatic ejection of the welded bearing shell.

Two New Sheffield Gaging Devices

The bench type electronic precision measuring instrument for gaging lead, taper, straightness, and concentricity of straight and tapered plain and thread ring gages shown in Fig. 1 is a recently announced product of the Sheffield Corporation, Dept. M, Dayton 1, Ohio. This instrument has a capacity for checking ring gages

Fig. 1. Precision measuring instrument for ring gages made by Sheffield Corporation

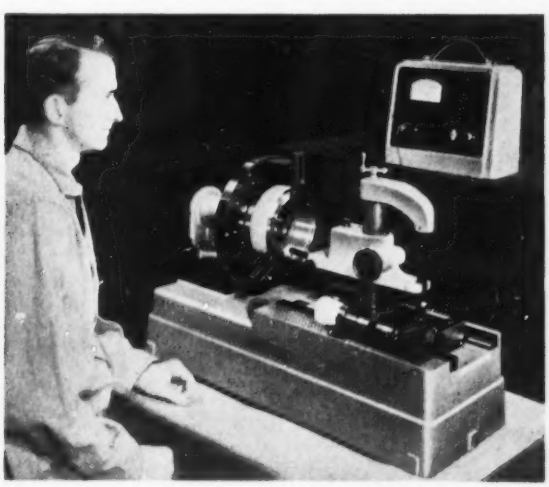


Fig. 2. Sheffield automatic gage for the inspection of automobile pistons

up to a maximum inside diameter of 8 inches and a maximum outside diameter of 10 inches. It has a cast-iron base 32 by 12 inches on which is mounted a rotating faceplate, an electronic pick-up stylus on a gaging arm that is adjustable vertically on a column mounted on a ball-bearing slide, a micrometer screw for use with precision end measures, and an electronic amplifying indicating unit. The rotating faceplate can be swung through a 90-degree arc so that it rests on a horizontal precision sine-bar fixture.

The amplifier with an amplification of 2000 to 1 can be remotely located for operator convenience. It has a zero center equilinear scale with 0.00005-inch graduations over a range of 0.0015 inch. Interchangeable ball-point gaging tips in sizes of 0.030, 0.050, 0.080, and 0.125 inch are supplied with the instrument to permit the gaging of almost any thread. Lead is checked by presenting the stylus to the thread at intervals determined by end gages and reading the error on a micrometer.

The automatic gage for simultaneous inspection of ten dimensions on an automobile piston at a rate ranging from 400 to 800 pistons per hour seen in Fig. 2 is another recent development of the Sheffield Corporation. This gage has a pneumatic and electrically timed loading mechanism that carries the piston into and out of the gaging station but can be loaded manually if desired. This "Multichek" can be used to inspect pistons for top land, top groove, second groove, bottom groove, and bottom land diameters and to determine whether the top and bottom skirt diameters are the same size and within the specified tolerance. It also inspects the width of the top groove, second groove, and bottom groove.

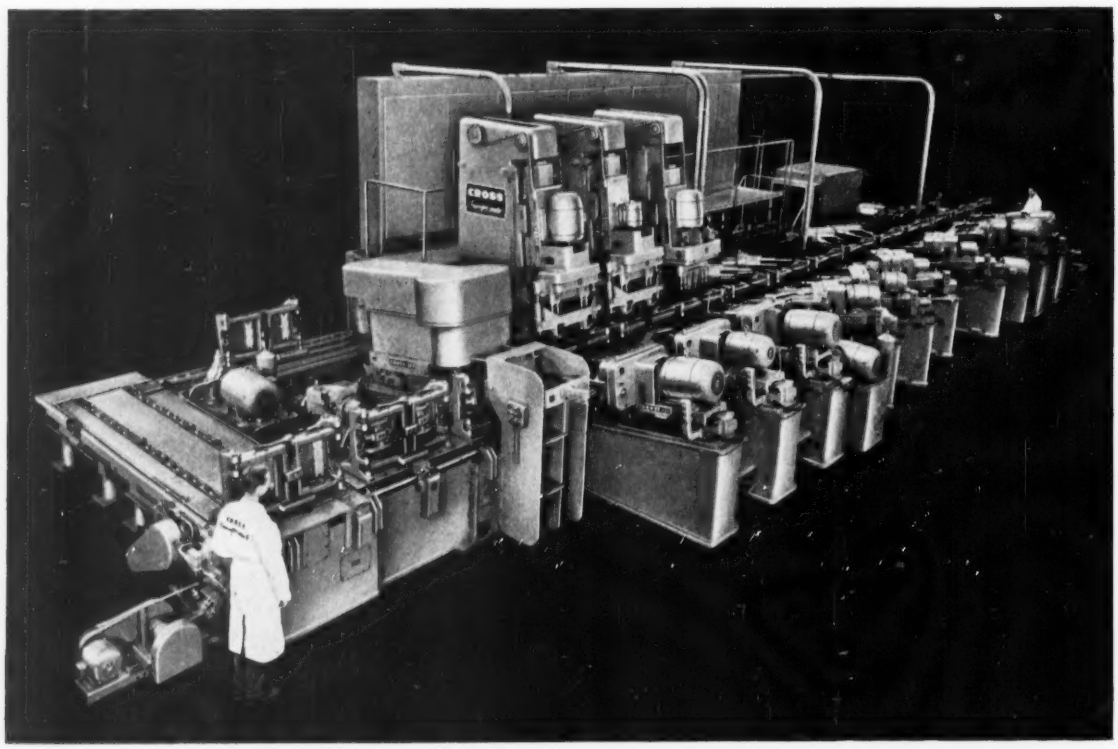
Colored lights indicate whether the points of inspection are oversize, under size, or within tolerance. When all of the dimensions are within the required tolerance, the master light remains white and the nine signal lights black out. If, however, one or more dimensions are out of tolerance, the master light turns red, a bell rings, and the signal lights indicate the faulty dimensions by turning red or green, indicating under-size or over-size conditions, respectively.

Bottom and top skirt diameters are gaged on this instrument by means of an air ring connected to a double-column "Precisionaire". The floats in the two glass columns are balanced so that they will be in a parallel position when the bottom skirt diameter is the same size as the top skirt diameter, with any deviation from the plus or minus 0.00025-inch tolerance being read on the graduated scales.

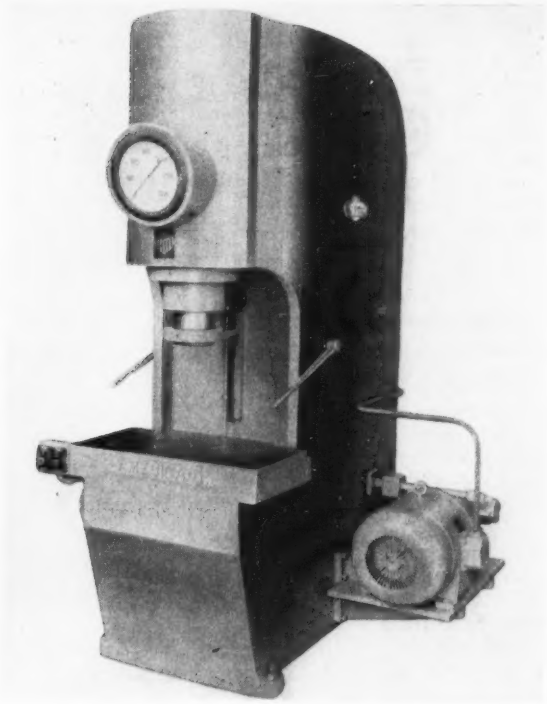
Cross Special "Transfer-matic" for Machining Intake Manifolds

The Cross Company, Dept. M, Detroit 7, Mich., has announced a special "Transfer-matic" machine designed to process two parts at a time. This machine has fourteen stations—twelve working, one loading, and one unloading. It machines intake manifolds at the rate of 206 per hour, performing two milling, forty-eight drilling, four boring, twenty chamfering, four spot-facing, and twenty-two tapping operations.

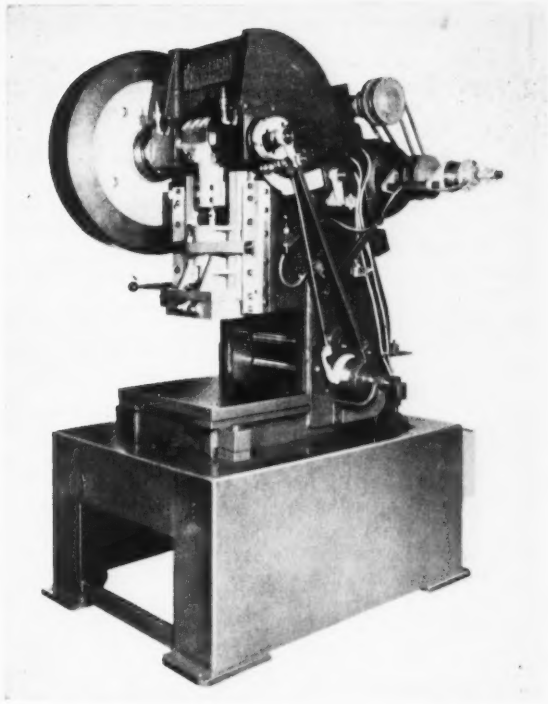
Outstanding features include palletized work-holding fixtures with power wrenches for automatic clamping and an integral conveyor for automatic return of



Special "Transfer-matic" built by The Cross Company for rapid machining of intake manifolds



Hydraulic straightening press manufactured by the American Broach & Machine Co.



Automatic Flexopress equipped with "Revertomatic" variable-speed drive

palletized fixtures from the unloading to the loading station. In addition, this machine is equipped for automatic chip removal, has hardened and ground ways, and an automatic lubrication system. Electrical and hydraulic construction is made to Joint Industry Conference standards.

"Dypral" Water-Soluble Chemical Coolant

Dynamic Industrial Products, Inc., Dept. M, Danbury, Conn., has introduced a general-purpose coolant called "Dypral," which is said to make possible greatly increased machine tool speeds and feeds as well as considerably longer tool life. This coolant is completely water soluble and free from oil, but meets most requirements for cutting, sawing, and grinding. Dypral can be used in machining many metals difficult to process, and also on light metals and plastics. This odorless coolant does not smoke or become rancid during use.

Greatly increased speeds permit the use of higher proportions of water—the ratio ranging from 1 part Dypral to 10 parts water for tapping, drilling, and threading to 1 part to 50 parts water for general grinding.

Vertical Hydraulic Straightening Press

A vertical hydraulic straightening press with provisions for rapid advance, power pressing, and rapid return is being manufactured by the American Broach & Machine Co., Dept. M, Ann Arbor, Mich., in 75-, 100- and 150-ton capacities. As illustrated, this machine can be supplied with a large dial type pressure gage and remote control adjustment for relief valve setting.

The hydraulic circuit includes two separate pumping units, both of which are used for the rapid advance and return stroke. Only one of the units is used to develop the maximum pressure required for the power pressing stroke. A decompression valve in the hydraulic circuit automatically prevents high-pressure shock when the machine ram stroke is reversed.

High-Speed Automatic Flexopress

The Precision Welder & Flexopress Corporation, Dept. M, 138 E. McMicken Ave., Cincinnati 10, Ohio, has introduced a 50-ton high-speed automatic stamping press known as the Model C-50, which is designed to reduce material handling and speed up the production of stampings. This press is equipped with a new adjustable-speed drive called the "Revertomatic" which permits engaging the clutch low-speed drive and building up to a predetermined high speed at an adjustable rate. Upon releasing the clutch, the press returns to low speed.

The intermittent feed-roll brake is designed to operate in rhythm with the machine in automatic operation and is cam-actuated to apply braking when necessary without a continuously dragging action. The ram is mounted in ball bearings that operate in hardened and ground tool-steel raceways designed to insure positive alignment. Feed rolls built as an integral part of the machine are infinitely adjustable through an over-running clutch to provide a feed range of from 0 to 15 inches.

This press will feed, blank, and stamp thin aluminum foil as well as the heavy materials available in coil stock form. The speed is infinitely adjustable from 90 to 350 strokes per minute, using a 7 1/2-H.P. motor and the standard 3-inch stroke. With the special 8-inch stroke, the speed is 50 to 150 strokes per minute.

Reed-Prentice Injection Molding Machine

Machine cycle time of six seconds permits up to 600 shots per hour on a new plastic injection molding machine brought out by the Reed-Prentice Corporation, Dept. M, Worcester 4, Mass. This 175T 4-to 6-ounce machine is designed for fast, continuous molding of small thermoplastic items. It develops 175 tons mold-clamping pressure through its double-shear link mechanism. The mold stroke is adjustable between 5 and 8 inches.

Four tie-bars of 3-inch diameter support the die-plates, which measure 22 by 24 1/4 inches. These die-plates will accommodate molds up to 24 1/4 by 13 inches. The rated projected casting area in the mold is 75 square inches. Maximum mold thickness is 14 inches and minimum mold thickness, 6 inches.

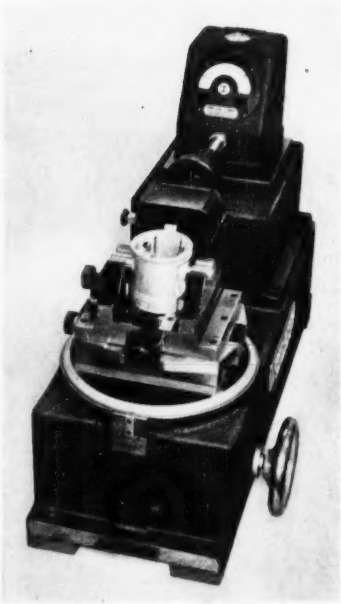
A stuffing arrangement is furnished which permits making "shots" of 6 ounces or more through multiple strokes. An optional low-pressure die-closing unit enables the machine to operate automatically on fast cycles without the danger of causing damage to the mold.

The plasticizing capacity is 75 pounds of material per hour with the new ceramic heating elements. Dual proportioning type pyrometers control heater temperature. The feed hopper holds a 200-pound plastic material drum at a 45-degree angle. Hydraulically and electrically interlocked safety doors are provided at the front and rear of the machine. Opening of a safety door during any part of the operating cycle causes the dies to open.

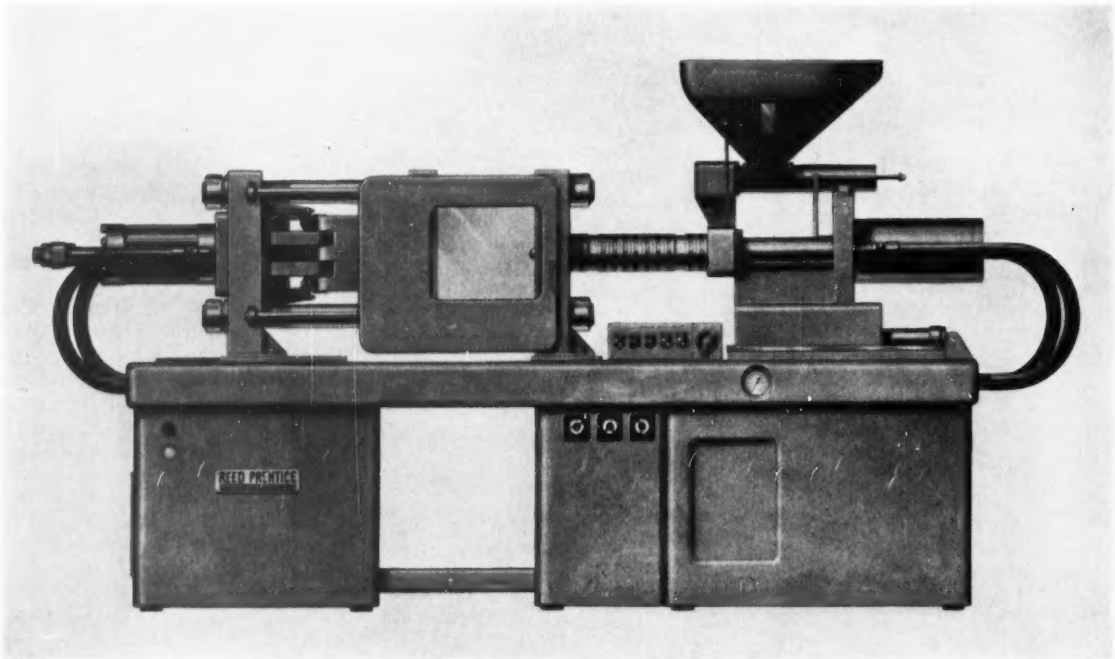
Taft-Peirce Air Gage for Inspecting Contour of Piston Skirt

An air-operated gage for measuring the skirt sections of automobile pistons built by the Taft-Peirce Mfg. Co., Dept. M, Woonsocket, R. I., is here shown. The gaging fixture and centralizing table are mounted on an index-table graduated in 5-degree increments, which can be rotated 360 degrees. The tungsten-carbide measuring contact is reed-mounted and horizontally adjustable to permit the inspection of pistons of various sizes. Magnification of the standard single-dial "CompAIRator" is 415 to 1, with dial graduations of 0.0002 inch. A built-in master setting device insures accuracy of readings.

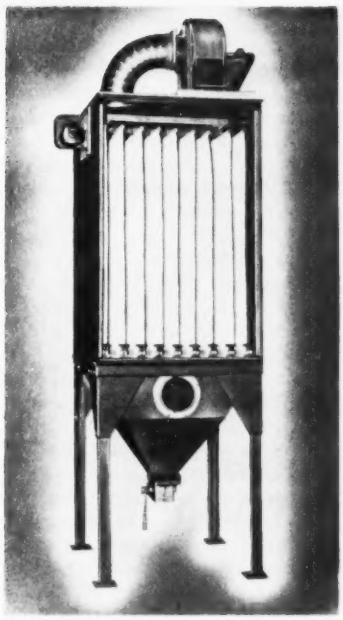
The piston is clamped in the correct position between a V-block locator and an opposing cushion block. After the centralizing table has been adjusted to the individual piston, the oval-shaped skirt contour can be checked for deviation at any radial point by rotating the index-table. The gage illustrated will check pistons from 3.5 to 4.0 inches in diameter, having a tolerance of as much as 0.0075 on the radius.



Taft-Peirce air gage for inspecting pistons



Injection molding machine brought out by the Reed-Prentice Corporation



Dust collector recently announced by the Pangborn Corporation

Pangborn Dust Collector

A unit type CN cloth bag dust collector, designed for small-volume applications, is announced by the Pangborn Corporation, Dept. M, Hagerstown, Md. Each unit is self-contained and shipped assembled ready for installation. This collector is designed for indoor use and is so arranged that the cleaned air can be discharged frequently inside the plant. Fine dusts of carbon black, cork, wood, graphite, pigments, lime, lamp black, and metal oxides are collected through cloth filter bags and deposited in hoppers for easy removal. The collector is available in seven sizes with cloth areas ranging from 200 to 1000 square feet.

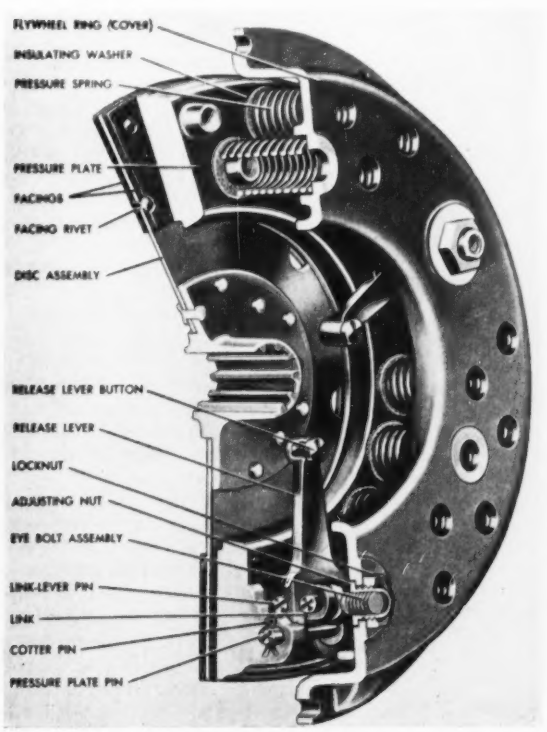
Non-Adjustable Direct-Pressure Clutch

A heavy-duty, non-adjustable, direct-pressure clutch has been brought out by the Lipe-Rollway Corporation, Dept. M, 712 Emerson Ave., Syracuse 1, N. Y. Rugged construction and broader interchangeability with other direct-pressure clutches in the field are advantages claimed for this clutch. Other features include high torque capacities, a minimum number of parts, low release loads, and positive engagement to provide for extra heavy duty and to meet the demands of applications that require the non-adjustable feature. The clutch is of the dry-disc push type construction, and has been designed to minimize the requirements for periodic inspection, maintenance, and replacements. Single- and double-plate models have ample capacities for engines developing from 200 to 1400 foot-pounds of torque.

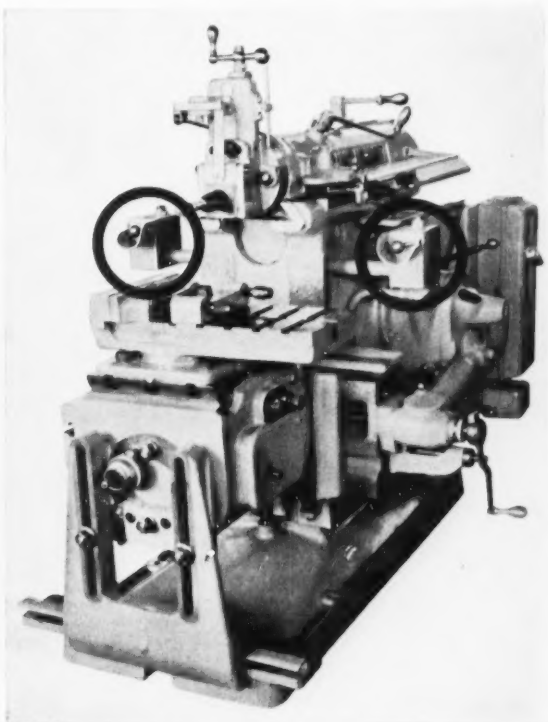
Dual Controls for Cincinnati Shapers

The Cincinnati Shaper Co., Dept. M, Hopple, Garrard, and Elam Sts., Cincinnati 25, Ohio, is offering dual controls as an extra feature for the electromagnetic brake and clutch used on their metal-working shapers. This additional control is designed to permit more efficient handling of large, awkward work which may obstruct the operators' view from the normal working position.

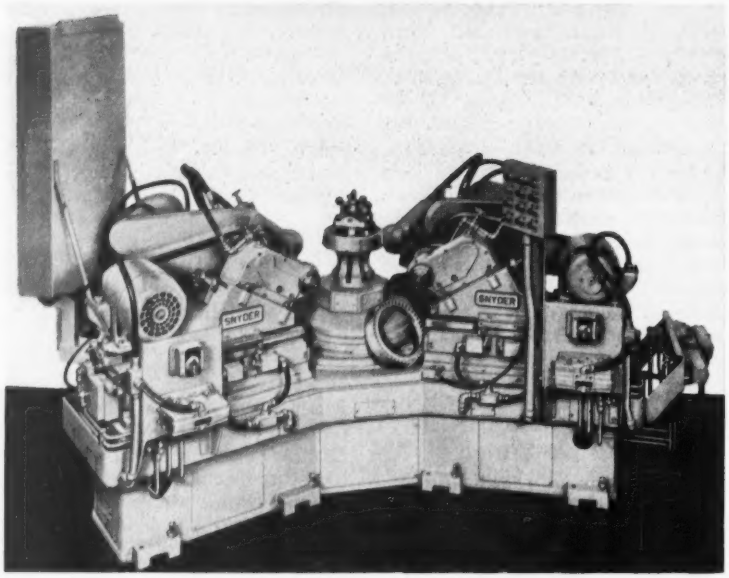
Other features which have been added to these machines to further increase operator efficiency are an automatic tool lifter; power down feed to the head with automatic stop; and an auxiliary front cross-feed screw. The dual controls are shown encircled on the machine illustrated.



Heavy-duty non-adjustable direct-pressure clutch introduced by Lipe-Rollway Corporation



Cincinnati shaper equipped with dual controls for electromagnetic brake and clutch

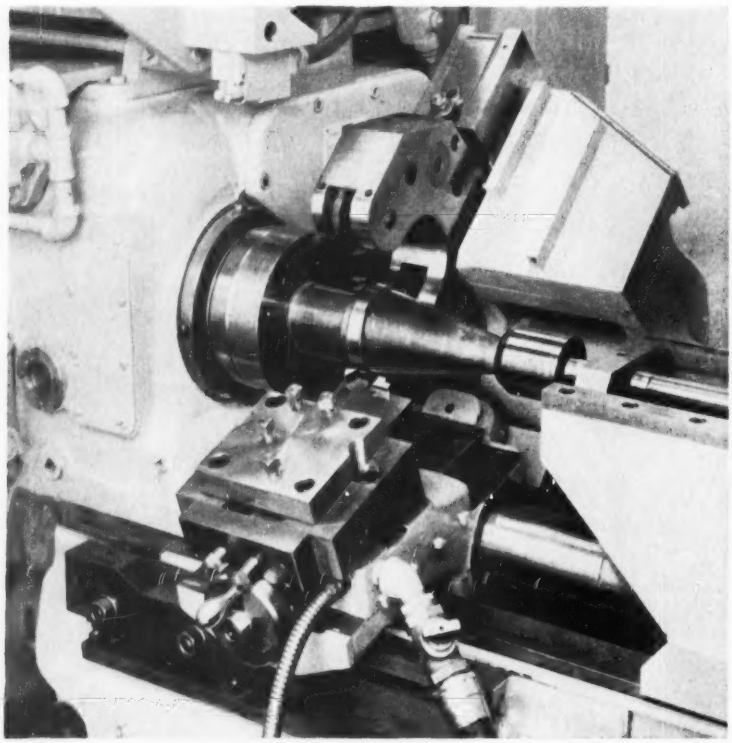


Special machine for milling slots in circular part of cast aluminum-alloy parts made by Snyder Tool & Engineering Co.

Snyder Automatic Cycle Four-Way Machine

An automatic cycle, four-way special machine for milling eight slots in a circular part of cast aluminum alloy, is announced by the Snyder Tool & Engineering Co., Dept. M, 3400 E. Lafayette, Detroit 7, Mich. A part to be machined is loaded and clamped manually on a fixture that oscillates through a 90-degree arc. When the starting button is pressed, the four tools advance rapidly and proceed to mill the first four slots. The high-speed steel tools have a hydraulically controlled feed rate of 32 inches a minute and a speed of 350 surface feet per minute. The drive to the spindles is through a V-belt and gears.

When the first four slots are milled to the required depth, the tools withdraw and the fixture indexes through a 90-degree arc, bringing the work-piece into position for milling the second group of four slots. When these are milled, the tools retract, the machine is indexed to the original position and stops, after which the part is unloaded. Production is 72 pieces an hour at an operating efficiency of 80 per cent. The machine is completely interlocked electrically to prevent malfunctioning and can be operated by an unskilled worker. Power is supplied to the spindles by four 1 1/2-H.P. motors and there is one 5-H.P. hydraulic motor. Lubrication is through a hand-pumped, central system. Coolant is supplied from a separate tank and pump. The machine requires a floor space 98 by 140 inches.



Fay automatic lathe with Salvo thread-rolling attachment mounted on the back cross-slide

Salvo Thread-Rolling Attachment for Fay Automatic Lathes

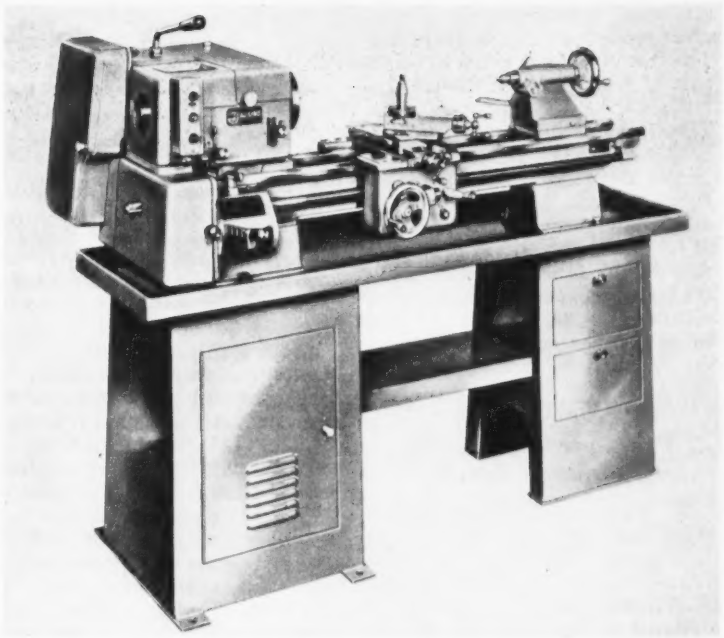
The Salvo Tool & Engineering Co., Dept. M, Roseville, Mich., has announced a thread-rolling attachment designed for use on the Fay automatic lathes made by the Jones & Lamson Machine Co., Springfield, Vt. This precision thread-rolling attachment is mounted on the back cross-slide of the lathe and operates at the normal spindle speed of the machine. It is actuated by a standard cam. The illustration shows a set-up now being used to roll special 3 1/4-12 threads.

This new attachment automatically positions itself on the work from the back cross-slide and forms close-tolerance external threads in thirty spindle revolutions. A taper is turned and the thread blank formed by tools on the front cross-slide of the machine. Close control over the pitch diameter is made possible by the accuracy of the thread rolls and by holding the blank diameter to a tolerance of 0.003 inch.

Clausing Heavy-Duty Precision Lathe

A Clausing 5300 heavy-duty 12-inch precision lathe is now being manufactured by the Clausing Division, Atlas Press Co., Dept. M, 5353 N. Pitcher St., Kalamazoo, Mich. A 1-inch collet, heavy-duty No. 3 MT tailstock with tang socket, 12-inch swing, twelve spindle speeds, 9-inch cross-slide travel, and 2 3/4-inch toolpost travel provide this lathe with the capacity for handling a wide range of work.

A built-in countershaft with friction clutch and brake, provision for instant selection of forty-eight threads or feeds (4 to 224 standard threads per inch), automatic splash lubrication, oil-flinger spindle bearing lubrication, and a steel cable V-belt drive are features of this lathe. Bed lengths are available that provide between center distances of 24, 36, and 48 inches. The swing over the bed is 12 3/4 inches, and over the saddle 8 1/2 inches.



Heavy-duty precision lathe made by Clausing Division, Atlas Press Co.

Delta Band Saw Equipped with "Jiffy" Tires

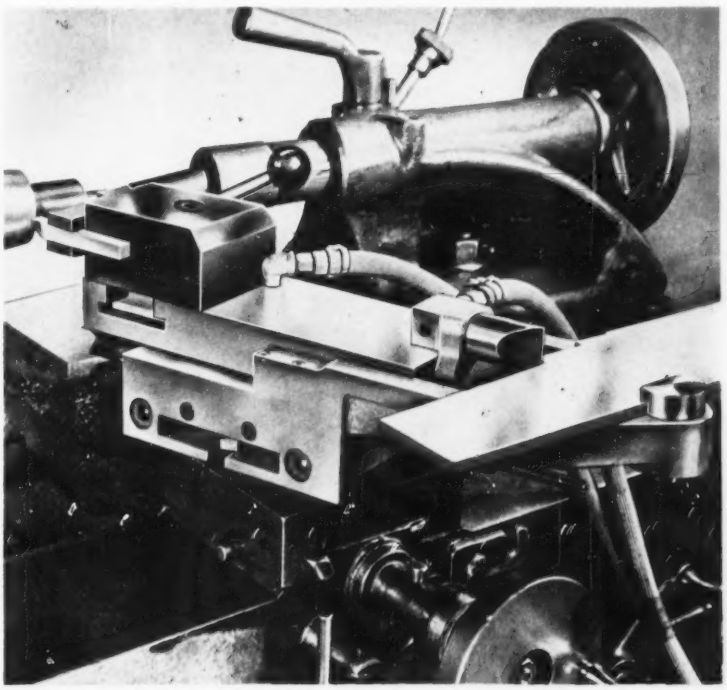
The Delta Power Tool Division, Rockwell Mfg. Co., Dept. M, 400 N. Lexington Ave., Pittsburgh 8, Pa., has introduced an improved version of its standard 20-inch band saw featuring rubber tires fused to pre-faced demountable steel rims. Use of the new tires—known as "Carter Jiffy Tires"—is said to reduce machine "down" time. A tire change previously involved removing the worn-out tire, cleaning the wheel, cementing on a new tire, and facing. The upper tire could not be faced properly because there was no way of driving the upper wheel. With these tires, the need for facing as well as cementing, is eliminated.

Lehigh Profile Tracing Tool for Medium-Size Lathes

A simple, mechanical duplicating attachment adaptable to medium-size lathes, such as those in the 16- to 24-inch size range, is being manufactured by the Air Control Division, Lehigh Foundries, Inc., Dept. M, 1500 Lehigh Drive, Easton, Pa. The attachment is mounted on a lathe after the compound rest is removed. The tracer tool is mounted directly on the cross-slide.

This tracer tool has a horizontal slide operating between two rows of pre-loaded ball bearings. Positive contact between the stylus and a 1/4-inch template is assured by air pressure from the shop line applied to the tool through a pressure regulator and a four-way valve.

A rotary stylus with a positive wedge lock is provided for high-production duplicating work. This permits the cross-feed screw to be



Lathe equipped with profile tracing tool manufactured by the Air Control Division, Lehigh Foundries, Inc.

set in one position for the successive production of duplicate pieces. The tracer tool has taken 3/8-inch cuts with a feed of 0.030 inch on Nitralloy bars during test runs. The stroke of the tool is 4 inches, or the equivalent of a range of 8 inches in the diameter of the work being turned. Right-angle shoulders can be turned in the direction of feed either externally or internally. Facing is done by positioning the tracer tool perpendicular to the cross-slide. The air-operated tool retraction arrangement permits threads to be cut right up to a shoulder.

Press for Compacting Powdered Metals

A multiple-action compacting press has just been built by the Eddystone Division, Baldwin-Lima-Hamilton Corporation, Dept. M, Philadelphia 42, Pa., which is designated the Model C. This is claimed to be the first press of its type specifically designed for the compacting of powdered metals. A feature of the new design is an arrangement that allows quick, accurate adjustment for changes of density or weight while the press is in operation.

Other features of this press include a hydraulic head, floating die-holder, independently floating core-rod, shuttle type feeder, automatic lubrication, and a choice of five different cycles.

Nilson Wire and Stock Reel with Oscillating Movement

A medium-size wire and stock reel with a 4-inch oscillating movement is being manufactured by the A. H. Nilson Machine Co., Dept. M, 1523 Railroad Ave., Bridgeport, Conn. The oscillating feature reduces the load on the feed mechanism and, by means of a limit switch, automatically stops the machine in case of wire entanglement on the reel.

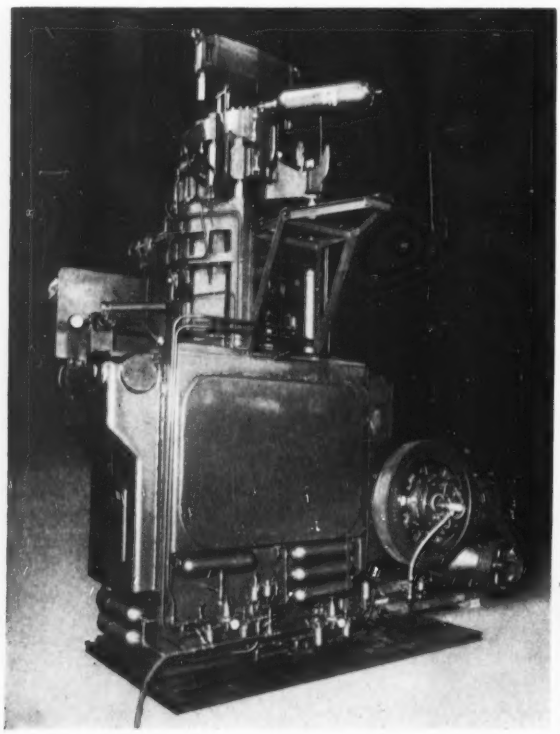
The new clutch reel is especially useful when used with medium-size wire coils in shops where an operator handles more than one machine. A spiral spring holds back the coil which is suspended and pivoted to a vertical shaft. The 4-inch oscillating movement compensates for pulls on the stock, and thereby reduces the load on the feed and prevents stock slippage. Overtravel of the reel beyond the 4-inch oscillating movement will automatically stop the machine through the use of a limit switch.

The clutch reel is furnished in two sizes—the Model 51-L with a coil capacity of 175 pounds and a minimum inside diameter of 8 inches, and the Model 51-M with a 250-pound coil capacity and a minimum inside diameter of 12 inches.

"Millimess" Amplifying Gage

The George Scherr Co., Inc., Dept. M, 200 Lafayette St., New York 12, N. Y., has announced an amplifying gage called the "Millimess," which is adapted for use in many types of comparison indicating gages and which can be built into machinery, fixtures, and special gages. It differs from conventional dial indicators in that it has no gear trains. It is designed for a high degree of sensitivity and for uniformity in repetition gaging work. The gage is shockproof, and is provided with an extra lift of 5/32 inch which prevents damage as a result of gaging over-size work.

Replacement of the lifting lever by an ingenious cable release, which lifts the contact point by re-



Compacting press built by Eddystone Division, Baldwin-Lima-Hamilton Corporation

Wire and stock reel now being manufactured by the A. H. Nilson Machine Co.

Amplifying gage announced by the George Scherr Co., Inc.

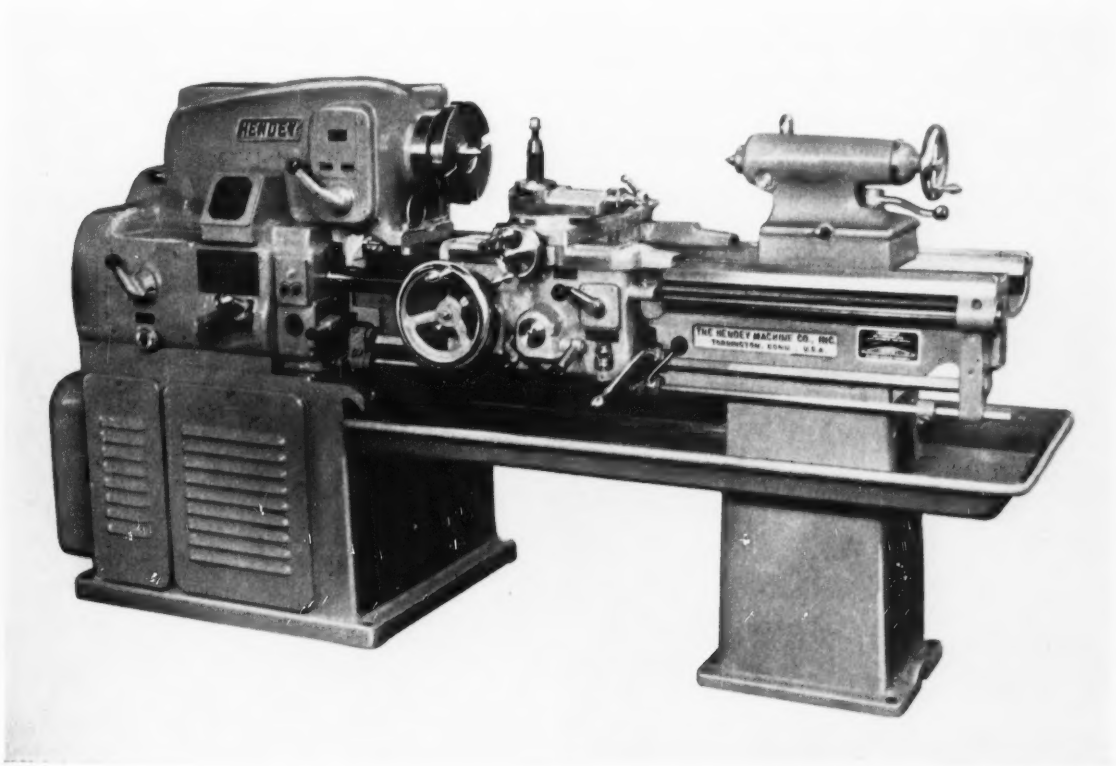
mote control, eliminates any effect of hand temperature, unequal pressure, and vibration. Zero adjustment of the indicator hand is obtained by means of a knurled thumb-screw on the outside of the housing. The setting of tolerance hands is simplified by their location on the outside of the dial. Two models are available—Model A reading in 0.0005 inch with a range of 0.020 inch and Model B reading in 0.0001 inch with a range of 0.004 inch. Either model can be furnished with a stand for use as a high-precision comparator. The stand has a table diameter of 2 inches and the distance from the contact point to the column is 2 inches. The vertical capacity of these amplifying gages is approximately 4 1/2 inches.

Hendey General-Purpose Precision Lathe

The Hendey Machine Co., Dept. M, Torrington, Conn., is introducing a No. 2 general-purpose precision lathe equipped with electronic motor control. This lathe has a single dial control for the infinitely variable drive which permits changing the spindle speed while the machine is taking a cut. The electronic unit of this drive contains only three 18-ampere heavy-duty rectifier tubes in the power circuit, and one smaller rectifier tube in the control circuit. A positive, no-slip belt drive is provided between the motor and the work-spindle. Stepless speed changing from 15 to 1500 R.P.M. is provided by potentiometer control of both the field and armature of the 5-H.P. direct-current motor. Extremely close speed control is achieved with this equipment, even under changing load conditions, and full torque can be attained at low speeds over the complete armature control range.

A thermal overload relay protects the motor from sustained overloads. The unit is said to be unusually quiet in operation, even under load. Instantaneous electric dynamic spindle braking and starting, stopping, and reversing are controlled by duplicate single levers at the headstock and apron.

The electronic unit requires 220- or 440-volt, single-phase, 60-cycle current (550-volt, 60-cycle, optional). The 230-volt motor requires a line load of 4.2 kilovolt-amperes. Rectifier tubes are warranted for 3000 hours at full capacity. However, since they normally operate well below the rated capacity, much greater life can be expected, 10,000 hours of life being commonly attained by the type of tubes employed.

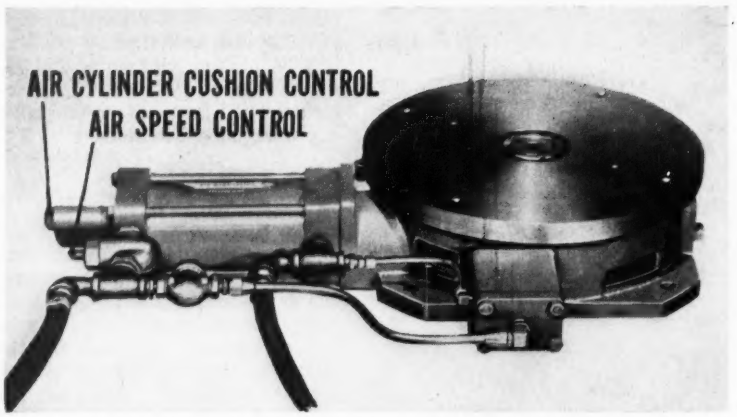


Front view of Hendey general-purpose precision lathe with electronic drive and single dial control of spindle speed

Index-Table Provided with Adjustable Speed and Cushion

Air-Hydraulics, Inc., Dept. M, 254 Belden Road, Jackson, Mich., has brought out an air index-table on which both the cushioned stop and air speed are adjustable to compensate for variations in load weights and diameters. As loads and diameters are increased, cushioning can be increased to allow maximum speed of operation without damage to the mechanism or work.

When operated with a 200-pound load, 22 inches in diameter, using an eight-station ring, indexes were claimed to be made at a rate of 100 per minute, with a load of 300 pounds, 60 indexes per minute. The indexing mechanism is said to be completely positive, without backlash, skips, or over-runs. Line pressures ranging from 60 to 175 pounds are sufficient to operate the table.



Air index-table being marketed by Air-Hydraulics, Inc.

Danly Automatic and Primary Die-Stops

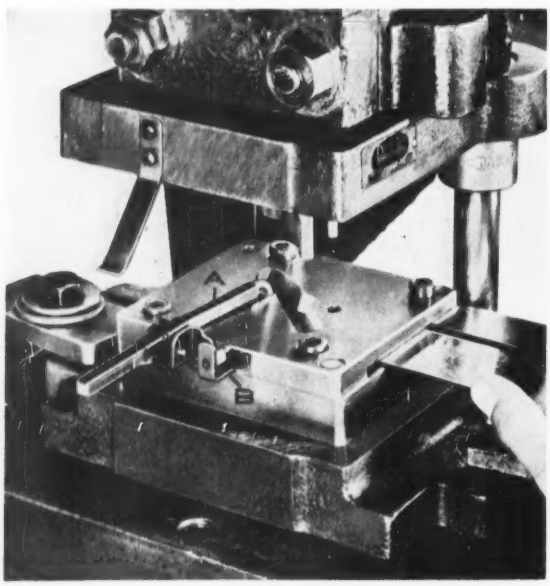
A new type of automatic die-stop *A* and primary die-stop *B*, shown in the illustration, are being marketed by Danly Machine Specialties, Inc., Dept. M, 2100 S. Laramie Ave., Chicago 50, Ill. The automatic and primary stops and the trip spring are designed for adaptability to any die, and they can be hardened after fitting, if desired.

These stops can be fitted in ten to fifteen minutes and can be used on strippers 5/16 inch thick and up. Made in two sizes—3/16 inch by 5 inches and 1/4 inch by 6 inches—the stops are available for right- or left-hand feeding and are adaptable to blanking, progressive, and compound dies. Universal stops are individually packed with trip spring and mounting screws.

All-Purpose Tool and Drill Grinder

Simplicity, convenience, accuracy, and speed are outstanding advantages claimed for a low-cost, wide-range tool and drill grinder made by the Swanson Mfg. Co., and now available from the DoAll Co., Dept. M, 254 N. Laurel Ave., Des Plaines, Ill. A wide range of twist drills, from No. 60 wire size up to the 3/4 inch size, can be quickly and accurately pointed and sharpened with this unit. It permits the grinding of point angles from 45 to 75 degrees, clearance angles from 6 to 15 degrees, and chisel-point angles from 117 to 135 degrees.

Drills to be sharpened are held and positioned in a fixture that simplifies the angular settings, permitting even inexperienced and unskilled workers to obtain good grinds. The grinder has a 1/4-H.P. ball-bearing motor and is equipped

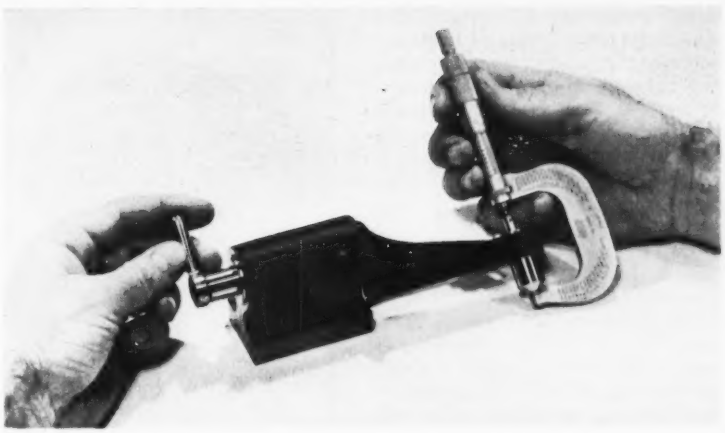


Die equipped with Danly automatic and work-locating stops

Tool and drill grinder placed on the market by the DoAll Co.

with a rough wheel for rough-grinding tools rapidly to the approximate angles. They can then be accurately finished on the other wheel using the fixture. The average time required to sharpen a drill is said to be less than one minute.

A drill point gage is furnished for quick checking of the chisel point, clearance, and point angles. The unit is available for bench mounting or with a steel cabinet pedestal. A tool bit fixture is furnished to permit the accurate grinding of angles on small lathe tools of commonly used types.



"Little General" radius dresser, product of General Scientific Corporation

Oster Portable Threading Machine

The Oster Mfg. Co., Dept. M, 2057 E. 61st Place, Cleveland 3, Ohio, is introducing a portable low-cost power-drive pipe threader called the No. 142 "Featherweight Champ". Weighing 75 pounds, this machine can be easily used by one man. Nevertheless, it is said to be a powerful machine. It is available with either gas or electric power. The threading range is from 1/8 inch to 2 inches.

Over-all dimensions of the machine, exclusive of the legs, are height, 18 3/4 inches; width, 15 inches; and length, 11 1/2 inches. A 1/2-H.P. continuous-duty, universal, reversible, variable-speed motor drives the machine. Spindle speeds range from 22 to 36 R.P.M., varying with the load.

Precision Radius Dresser

The General Scientific Corporation, Dept. M, 603 N. La Brea Ave., Los Angeles, Calif., has developed a radius dresser called the "Little General." This device is rigidly constructed for smooth operation and to give the machinist a sensitive "feel of the wheel" when dressing to a radius. Angles tangent to the radii can be quickly and easily dressed. Settings can be made rapidly and accurately for dressing radii of 0.001 and 0.002 inch (needle diamond permitting) and up to 9/16 inch. Diamond concentricity is adjustable. The illustration shows a simple setting operation of the radius dresser.

Adapter Bushings for Gripping Tools in Holders Used on Screw Machines

A line of bushings for gripping drills, reamers, taps, and boring tools in floating and other types of holders used on automatic screw machines is being manufactured by Precision Steel Products, Inc., Dept. M, New Lebanon, Ohio. These bushings (one is shown gripping the shank of a drill in the bottom view of the illustration) consist of cylindrical steel members turned on a screw machine. Three grooves are turned on these members and they are drilled to fit the tool to be held. After being formed and drilled, each bushing

Portable pipe threading machine has been placed on the market by the Oster Mfg. Co.

Adapter bushings made by Precision Steel Products, Inc., for use on screw machine holders

is cut longitudinally through the center, forming a pair of identical half-members. Flat spring rings are assembled in the narrow grooves at each end of the half-members so that they cannot become separated but can be sprung apart slightly at their dividing line when the shank of a drill or other tool is inserted.

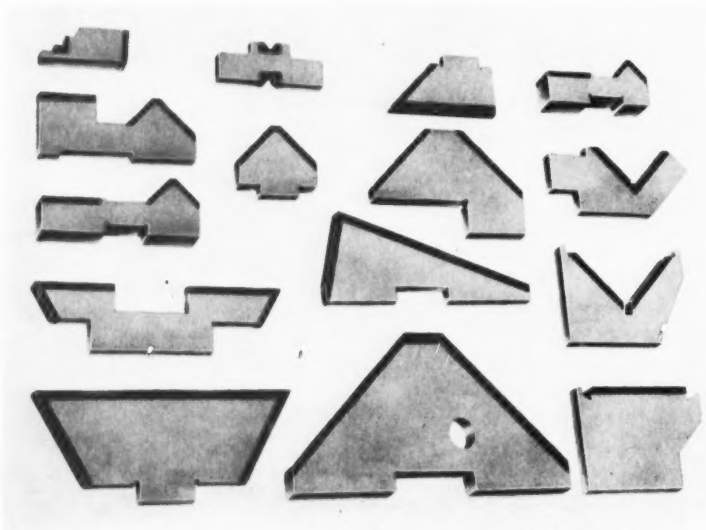
An assembled bushing can be placed in a drill-holder, after which a drill or other tool can be inserted in the bushing as illustrated in the two upper views. If desired, the drill or other tool can be inserted in the bushing before the bushing is inserted in the holder. The spring rings permit the halves of the bushing to spread sufficiently. A set-screw in a threaded hole in the wall of the holder engages the wide central groove on one of the half-members of the bushing, preventing longitudinal as well as rotational movement of the bushing in the holder. The set-screw also serves as a means of clamping the two halves around the shank of the drill or tool. The bushings are made in 1/2-, 5/8-, and 1-inch diameter sizes with holes varying in steps of 1/64 inch from 1/16 to 43/64 inch in diameter.

Reliance Alternating-Current Motors

A new line of well protected, versatile squirrel-cage induction motors has been announced by the Reliance Electric & Engineering Co., Dept. M, 1088 Ivanhoe Road, Cleveland 10, Ohio. The line, including protected and enclosed motors for all industrial purposes, is being built to recently adopted standards of the National Electrical Manufacturers Association. Greater horsepower has been made possible in a more compact space. Better protection of the windings, leads, and bearings is another advantage claimed for these motors.

Alternating-current motor of new line brought out by the Reliance Electric & Engineering Co.

The first motors of this line will be built for 1-, 1 1/2-, and 2-H.P. applications, in frame sizes 182 and 184. The balance of the line, up to and including 30 H.P., will be introduced at regular intervals during 1954 and the early part of 1955. The present Reliance alternating-current line of motors will continue to be available during this change-over period to fill the needs of those users who wish to complete current projects with motors as they are now being built.

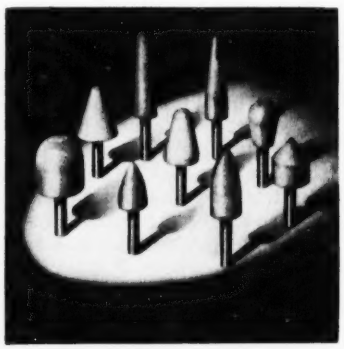


Bedways consisting of a tool steel laminated to a soft steel backing

Nu-Tex Mounted Abrasive Points

Mounted abrasive points, designed for use on all types of precision instruments and machinery, were recently announced by the Atlantic Abrasive Corporation, Dept. M, South Braintree 85, Mass. They are said to have a soft, cushion-like grinding action that cleans, polishes, and deburrs all types of metals and plastics in one simple operation.

Bonded together with a special resin, Nu-Tex points produce an even, extremely smooth finished surface and eliminate the need for such time-consuming hand operations as filing, scraping, sanding, and burnishing. These points will not clog or load even on the softer metals. They are now available in all popular grit sizes in grades ranging from 0 (hard) to 5 (soft).



Nu-Tex mounted abrasive points made by Atlantic Abrasive Corporation

Laminated Bedways

The Ohio Knife Co., Dept. 25, Cincinnati 23, Ohio, is presenting to the trade a wide variety of bedway shapes and sizes, some of which may be seen in the illustration. The bedways are fabricated by means of a laminating process in which long-wearing high-grade tool steel is welded to a soft steel backing under a pressure of 2500 tons.

Heat-treatment hardens the ways, 65 to 66 Rockwell C, to a uniform depth of 3/16 inch. The hardened surface helps maintain constant accuracy throughout the life of the machine. Hardened ways and gibs are ground to a tolerance of plus or minus 0.002 inch.

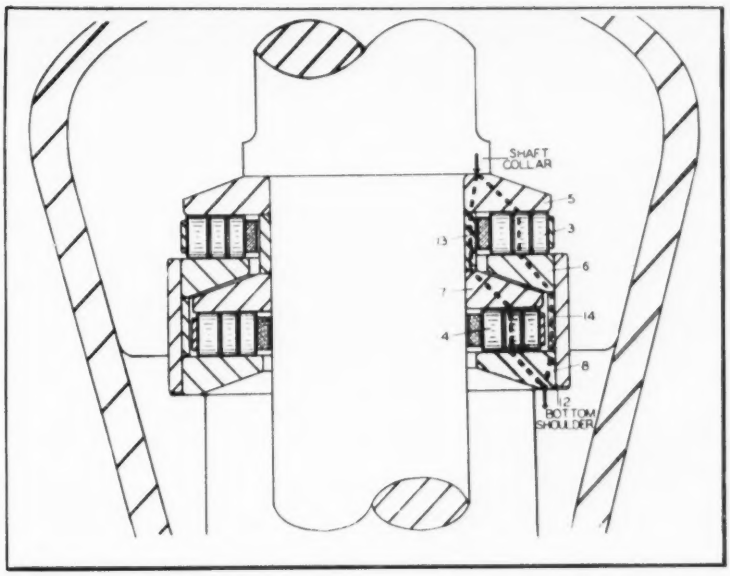


Diagram illustrating the construction and operating principle of tandem thrust bearing developed by the Rollway Bearing Co., Inc.

Tandem Thrust Roller Bearings Designed to Double the Load Capacity

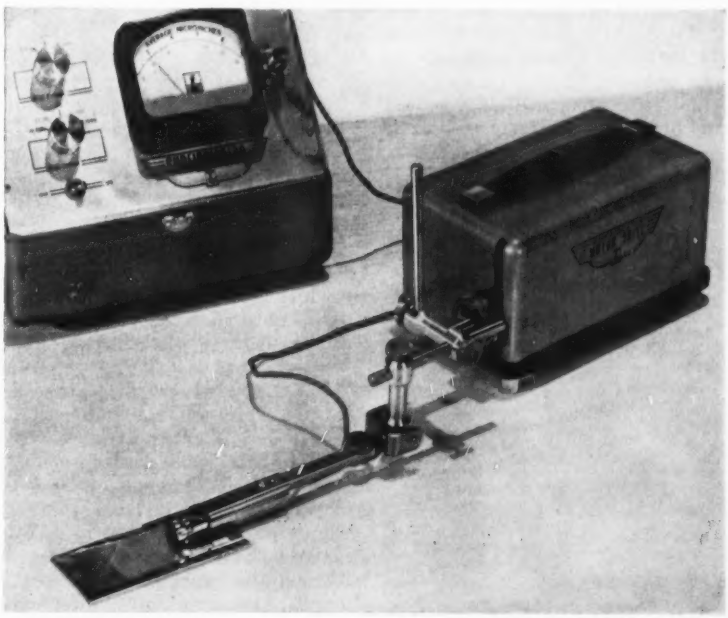
Thrust bearings seated in tandem along a machine shaft, one above the other, as shown in the diagram, are said to have twice the capacity and eight times the life expectancy of a conventional thrust bearing. These bearings, manufactured by the Rollway Bearing Co., Inc., Dept. M, Seymour St., Syracuse, N. Y., achieve these results without requiring any change in the basic machine structure in which they are used. Such heavy loads are taken in a confined area by having two bearings, mounted one atop the other, share equally the thrust load exerted by the machine shaft. Loads as high as 300 tons have been successfully supported by this type of bearing assembly when used on oil-drilling swivel shafts.

How the thrust load is split between the two bearings, doubling the amount of thrust that can be exerted along the shaft, is explained as follows: the outer plate (5) of the raceway for rollers (3) thrusts against the shaft collar, and the outer plate (8) for the rollers (4) thrusts, in turn, against a bottom casing shoulder (12). The thrust load is transferred from the outer, or uppermost, bearing plate (5)—the first bearing plate—with respect to the downward direction of the thrust, through the bearing plates and rollers in two paths: one path (shown by heavy dotted line nearest shaft) through compression sleeve (13) to bearing plate (7), roller (4) and plate (8); and the other path (shown by dotted line at right) through the rollers (3), the inner bearing plate (6), and a compression thrust sleeve (14) to the lowermost bearing (8), which thrusts against bottom shoulder (12). The compression members (13) and (14) are constructed to have the same amount of compression since they are formed of the same metal.

Motor Drive for Tracing with "Surfindicator"

The Brush Electronics Co., Equipment Division SP, Dept. M, 3405 Perkins Ave., Cleveland 14, Ohio, has announced a mechanical tracing accessory for use with the "Surfindicator," an instrument for measuring surface roughness. This accessory, the Model BL-114 Brush motor drive, provides mechanical movement of the "Surfindicator" pick-up along a surface being inspected. It is designed for special applications which extend the usefulness of the basic "Surfindicator" beyond the range that is practical with hand operation.

The length of the reciprocating stroke of the drive is adjustable from 2 7/8 inches to less than 1/16 inch, allowing for an extremely wide range of measurements. The stroke speed is 1/8 inch per second. Instantaneous reversal, constant speed, and low vibration level of the unit are said to insure surface roughness measurements of the highest possible accuracy, and to permit rapid inspection of similar parts and of very small normally inaccessible areas.



Brush motor drive applied to the "Surfindicator" for measuring surface roughness

Press brake introduced by the Service Machine Co.

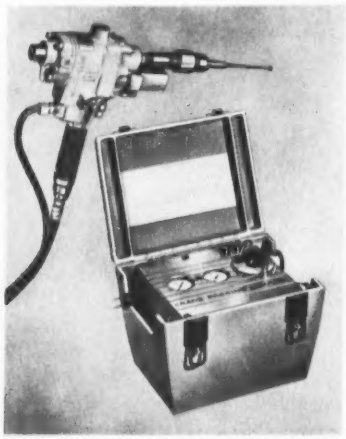
Semco Press Brake

A high-precision press brake of unusually strong construction has been announced by the Service Machine Co., Inc., Dept. M, 374 Miller St., Elizabeth, N. J. This 8-foot press brake has a capacity for bending 16-gage stock in widths up to 96 inches. It is designated the "Semco" Model 800, and supplements the 6-foot press brake recently announced by the company.

Tube Rolling Control

Development of a new electro-pneumatic tube rolling control that combines the advantages of air operation with precision electric control has been announced by the Crane Packing Co., Dept. M4, 1800 Cuyler Ave., Chicago 13, Ill. The unit is equipped with an air motor which provides increased power and flexibility for faster tube rolling. Ferrous tubes up to 2 1/4 inches in inside diameter, can be rolled. The unit is adaptable for the production of a variety of equipment, including condensers, heat exchangers, boilers, evaporators, coolers and dehydrators.

The control is designed to handle three sizes of "John Crane" air motors: Size No. 1 for non-ferrous tubing up to 2 1/4 inches, inside for non-ferrous tubing up to 1 1/2 inches and ferrous tubing up to 1 1/4 inches; and No. 3 for ferrous tubing up to 2 1/4 inches, inside diameter.



Tube rolling control unit marketed by the Crane Packing Co.

Fig. 1. Thor air-powered drill that features interchangeable parts

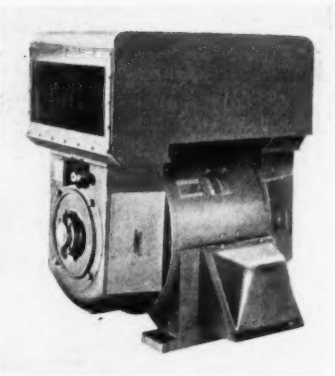
Fig. 2. Thor right-angle nutsetter

Thor Air Tools

Three series of air tools, covering applications from 1/4-inch drilling to 3/4-inch bolt-size nutsetting, have been placed on the market by the Thor Power Tool Co., Dept. M, Aurora, Ill. They are the Nos. 3, 35, and 5 series, all with interchangeable parts.

In the first group, one basic air motor powers four straight drills (which are convertible to direct-drive nutsetters), four right-angle drills, and four right-angle nut setters. Speeds will range from 3400 to 800 R.P.M. with capacities of 1/4, 5/16, and 3/8 inch.

The second group features three grip-handle drills in speeds of 1150, 800, and 550 R.P.M., with capacities of 3/8 and 7/16 inch. They may be converted to direct-drive nutsetters of 5/16-inch thread size capacity. In the No. 5 series, right-angle nut setters are offered in speeds of 600, 450, 300, and 225 R.P.M. for setting nuts of 1/2-, 5/8- and 3/4-inch sizes.



General Electric totally-enclosed unit-cooled direct-current motor

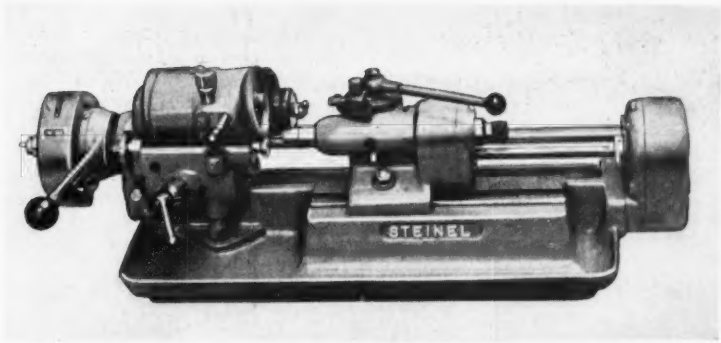
G-E Totally Enclosed Unit-Cooled Motor

A totally enclosed, unit-cooled, direct-current motor—developed for use under severe atmosphere conditions—has been announced by the General Electric Co., Dept. M, Schenectady 5, N. Y. This motor, said to be the smallest standard model of its type, is intended for application in machine-tool, cement, chemical, rubber, and steel-mill industries, and for materials-handling operations. It is available in ratings from 15 to 200 H.P. and features 50 per cent greater heat transfer in a 37 per cent smaller unit than previous designs.

Compact cooling units, mounted completely within the over-all length and width of the motors, permit operation at extremely low speeds for long periods of time, because proper ventilation does not depend on the motor speed. A double system of independently driven blowers assures rapid cooling. A thermostatic relay protects the main motor in case of blower-motor failure. These motors are available in the same speed and horsepower ratings as standard, constant, or adjustable-speed, general-purpose motors.

Steinel Pivot-Burnishing Machine

The Morey Machinery Co., Inc., Dept. M, 383 Lafayette St., New York 3, N. Y., is introducing in this country a new Steinel pivot-burnishing machine designed for the finishing of bearing surfaces on spindles, pivot shafts, drive journals, and similar work to insure proper size and improve surface quality. This machine is available in two models—SR2n which



Steinel pivot-burnishing machine introduced by Morey Machinery Co., Inc.

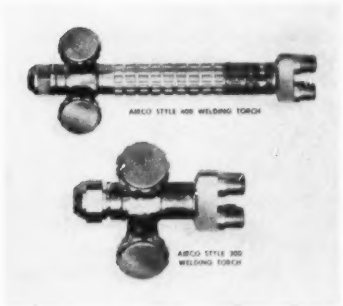
takes work from 0.019 to 0.078 inch in diameter, and SR3n which handles work from 0.039 to 0.314 inch in diameter.

Burnishing can be performed by this machine with tool-steel or tungsten-carbide discs. The tool-steel disc will remove metal faster than the tungsten-carbide disc due to its rougher surface. Although the carbide disc is slower in operation, it gives a better finish.

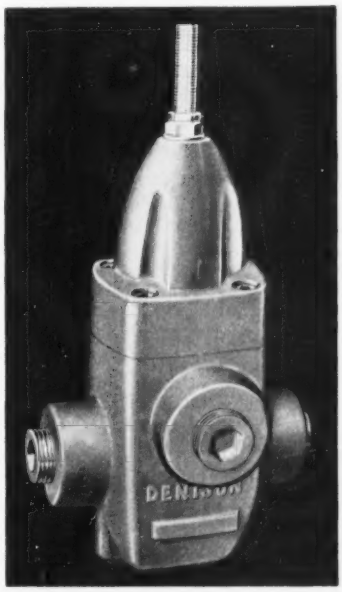
Airco Torches for Light Welding, Brazing, and Lead Burning

Two new Airco torches, designated Styles 400 and 300, are now available from the Air Reduction Sales Co., Dept. M, 60 E. 42nd St., New York 17, N. Y. The Style 400 torch is designed for light welding and brazing operations on automobile bodies, airplane fuselages, kitchen utensils, metal furniture, and other light fabrication and repair applications. This torch is 5 3/4 inches in length and weighs 6 ounces. The attachment is available for occasional cutting jobs.

Style 300 is a compact, light-weight torch designed primarily for oxy-acetylene burning or welding of lead products such as lead sheets, pipe, and storage battery parts. It is also suited for jewelry repair work, automobile radiator soldering, and light production welding. The torch weighs 5 ounces and is 2 1/2 inches long.



Airco oxy-acetylene torches for light welding, brazing and lead burning operations



Denison direct-operating sequence valve

Direct-Operating Sequence Valve by Denison

A complete line of direct-operating sequence valves suitable for operation in circuits ranging from 25 to 2000 pounds per square inch has been announced by the Denison Engineering Co., Dept. M, 1160 Dublin Road, Columbus 16, Ohio. The line provides precision control for interlocked hydraulic operations, insuring close synchronization of primary and secondary operations. Valve pressure settings may be easily adjusted. When the system pressure reaches the pressure setting of the valve, the oil is diverted to the secondary circuit.

Pressure build-up in the system brings immediate action of the pilot piston in the secondary circuit. This piston may be adjusted to shift at any pressure from 25 to 2000 pounds per square inch. The use of the small pilot-piston eliminates the need for heavy spring loading at high pressures. Sequence valves designed for operation in the ranges of 25 to 125 pounds per square inch and 75 to 250 pounds per square inch do not utilize the pilot-piston.

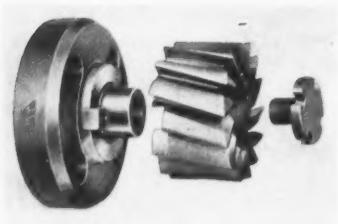
Micrometer caliper with built-in friction control mechanism introduced by the L. S. Starrett Co.

Starrett Micrometer Caliper with "Satin Chrome" Finish

A micrometer caliper introduced by the L. S. Starrett Co., Dept. M, Athol, Mass., has an improved friction control mechanism built into the upper portion of the thimble where it is easy to use for fast, accurate, repetitive measuring. This control is obtained through the outer portion of the thimble seen at *A* in the illustration. The spindle will not advance after the correct contact pressure is applied, insuring uniformly readings.

Another feature of the micrometer caliper is the lower, or "direct feel," section *B* of the thimble. This section is integral with the spindle and is conveniently located for quick and sensitive feel on critical measurements.

Other features of the micrometer include a "satin chrome" finish on thimble, sleeve, and frame to eliminate glare and resist stains and corrosion; a one-piece spindle for rigid internal construction; an adjustable sleeve that can be replaced if damaged or worn; quick-reading figures; and a tapered frame.

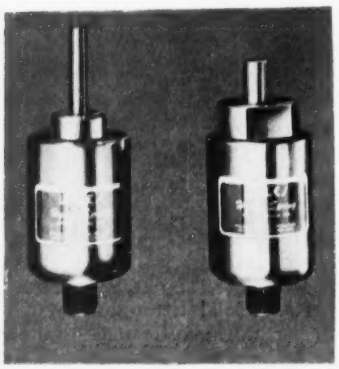


Adapter for Shell End-Mills

Quick-change type shell end-mill adapter developed by the Goddard & Goddard Co., Dept. M, 12280 Burt Road, Detroit 23, Mich. This adapter is standardized for No. 50 N. S. drive milling machines, and is available in two arbor sizes that fit the bores of standard shell end-mills. It can be rigidly mounted directly on the front spindle flange of the machine and has standard bolt holes and key slots to provide for positive driving. The adapter is made from 8620 steel and case-hardened to assure long, accurate service.

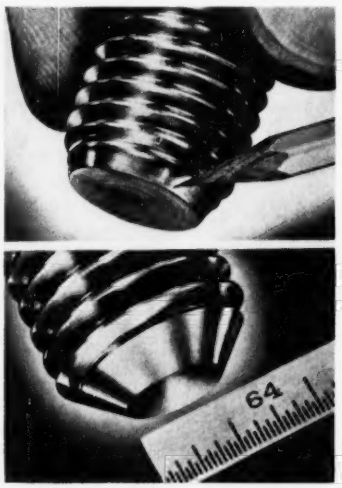
Wales High-Capacity "Hydra Springs"

Two new series of high-capacity Wales "Hydra Springs," using compressible liquids, just announced by the Hydra Spring Division, Wales-Strippit Corporation, Dept. M, 345 Payne Ave., North Tonawanda, N. Y. These springs provide up to 6000 and 8500 pounds force, respectively, in a relatively small space. This performance is the result of utilizing the compressibility of special fluids called Wales "Comproils." The springs measure 2 1/4 inches in diameter by 4 1/4 inches long and produce as much spring force as a large 6-inch diameter by 8-inch long railroad car spring made from 1 1/8-inch wire. The force and stroke of these springs can be adjusted by changing the preloads or the volume and type of the operating fluid used.



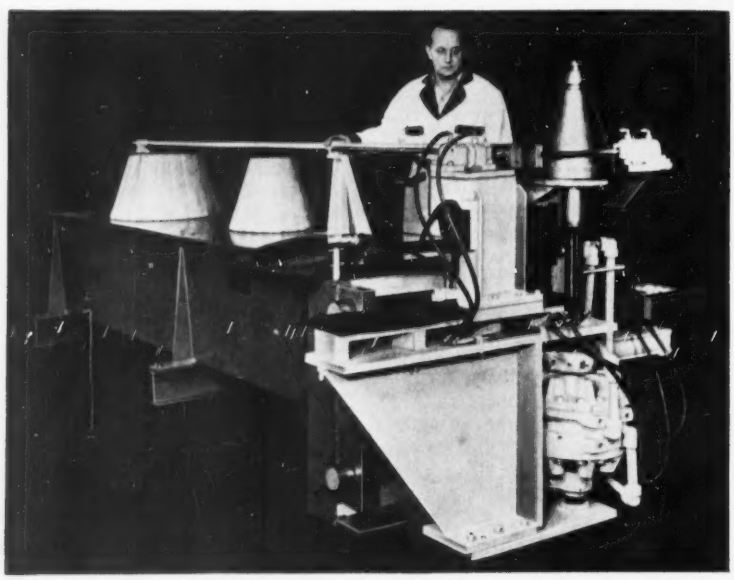
Improved Points for Allen Socket-Screws

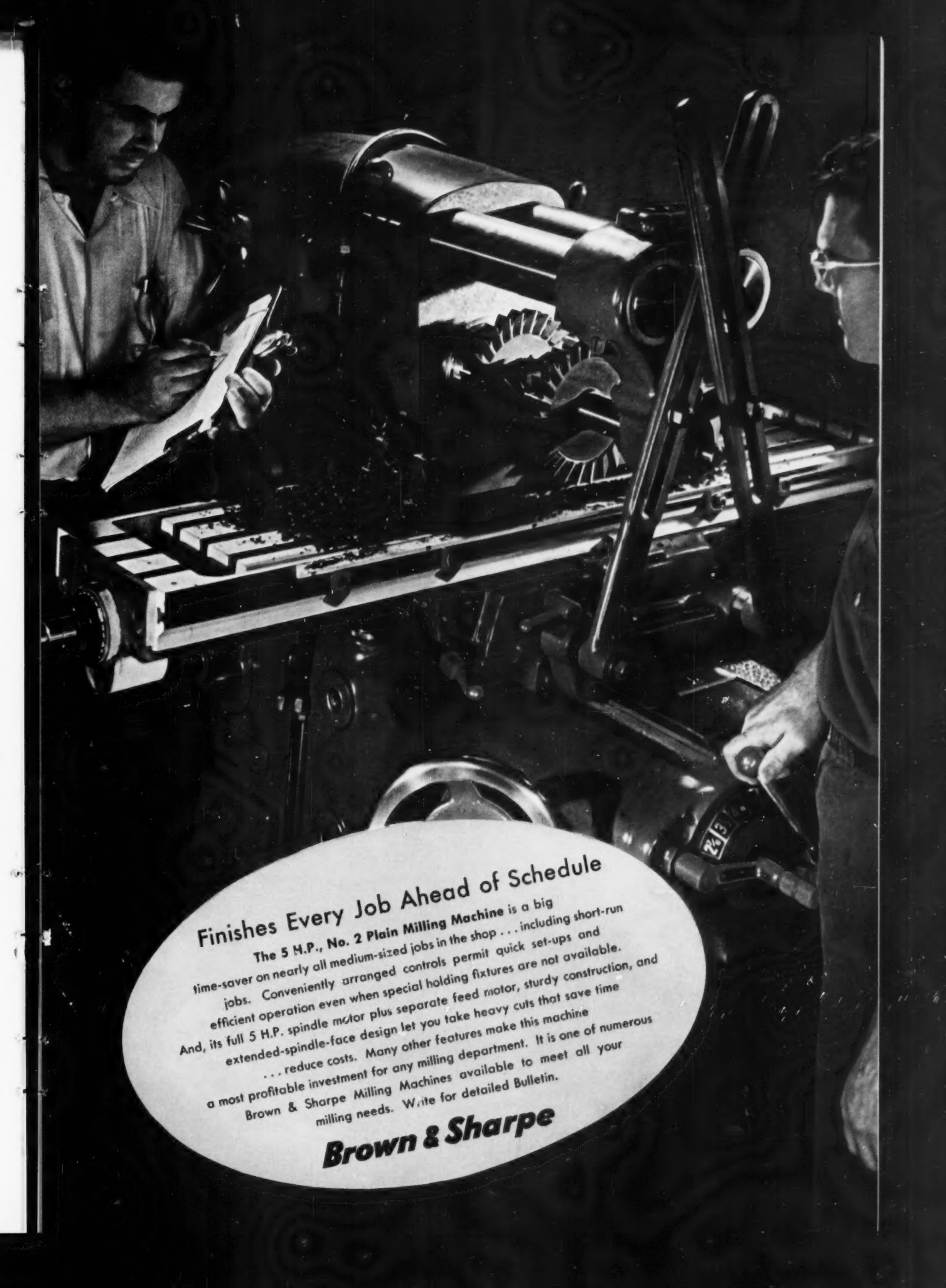
The Allen Mfg. Co., Dept. M, 113 Sheldon St., Hartford, Conn., announces two improved types of socket-screw points, one applied to set-screws and the other to cap-screws. A smaller cup point for set-screws called the Allenpoint, shown in the lower half of the illustration, will replace A.S.A. cup point set-screws in their standard line. The Allenpoint set-screw is available through industrial distributors in Allenoy and stainless steel, with either NC or NF threads. An unthreaded leader point, shown in the upper half of the illustration, designed to reduce the cause of screw thread injury and damage to threaded holes, has been developed for cap-screws. Improved line-up, particularly in inaccessible spots, and protection from damage resulting from dropping or knocking against other metal surfaces are some of the advantages claimed for the new leader point.



Semi-Automatic Tube Bending Machine

Semi-automatic hydraulically powered machine for making bends to radii ranging from 3/4 inch to 2 feet in finned or plain ferrous and non-ferrous metal tubing up to 40 feet in length. The machine bends tubing up to 1 1/2 inches in diameter around a cone-shaped steel die that is adjustable both vertically and horizontally to provide bending radii in infinitely variable increments within the large- and small-diameter range of the cone. Larger bending radii up to 2 feet are attained by nesting hard wood cones of larger sizes over the conical steel die. Four hard wood cones designed especially for this purpose provide the radius range up to 2 feet. Product of Walter P. Hill, Inc., Dept. M, 22183 Telegraph Road, Detroit 19, Mich.

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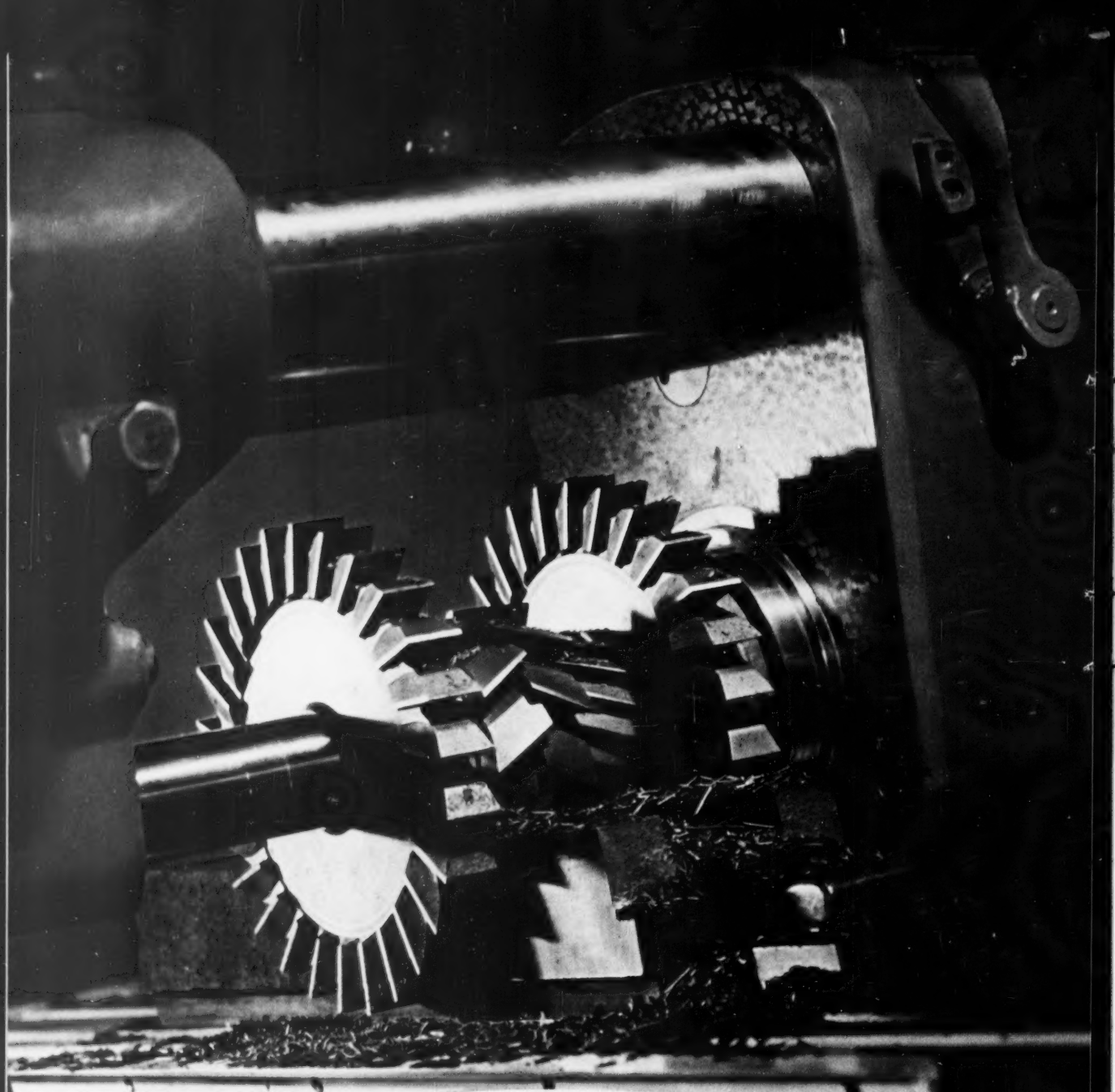

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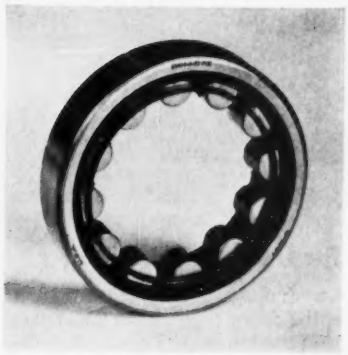
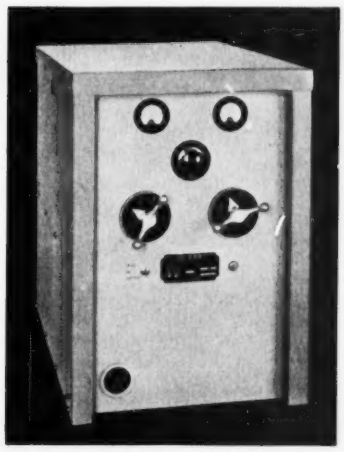


Roller Bearing Has Separable Inner Race

Rollway Bearing Co., Inc., Dept. M, 542 Seymour St., Syracuse, N. Y., has made its general-duty, Tru-Rol steel cage type cylindrical roller bearing available with or without a separable inner race. The bearing, which conforms to standard S. A. E. sizes, is a self-contained roller assembly consisting of an outer race, roller retainer, and rollers. Depending upon the application, either type bearing can be used—Type EB, with an inner race; or Type B, without. If the inner race is not used, the shaft that replaces the inner race must possess its identical finish and the same hardness characteristics.

Glenn Constant-Voltage Welder

A new 1000-ampere rectifier type direct-current welder is now being produced by the Glenn Co., Dept. M, 3134 E. 10th St., Oakland 1, Calif. The new unit is rated at 1000 amperes, continuous duty, with an infinitely variable pre-set arc voltage range of 18 to 42 volts. It operates on three-phase, 60-cycle alternating-current power, 240 or 480 volts. Efficiency is 85 per cent or better, and its power factor is 90 per cent. The stepless 18- to 42-volt arc range permits use of the unit for submerged-arc, inert-gas, and hand-operated automatic welding processes, as well as for automatic stud welding and compressed air-carbon arc-cutting and gouging operations.



Ther-Monic Induction Heating Generators

A 2 1/2-kilowatt Ther-Monic induction heating generator, designed for continuous heavy-duty operations and rough handling,

has been brought out by the Induction Heating Corporation, Dept. M, 181 Wythe Ave., Brooklyn 11, N. Y. Applicable to either short- or long-run jobs, this unit may be easily adapted to conveyor belt or turntable types of automatic feeds. Positive air pressure is maintained inside the steel cabinet in which the generator is housed, thus preventing dust and fumes from entering the enclosure. The low-voltage work coils used are safe to touch while energized. Protective devices include magnetic overload and live circuit breakers, a time delay relay, and water and door interlock switches.

Mead Versatile Column Type Presses

Two of four variations of a column press recently brought out by the Mead Specialties Co., Dept. CP-26, 4114 N. Knox Ave., Chicago 41, Ill. One adjustable stand takes air cylinders with a 3- or a 4-inch bore of either the single- or double-acting type. Double-acting cylinders (illustrated) can be furnished with any length of stroke up to 36 inches; single-acting cylinders have a maximum stroke of 4 inches with the return stroke actuated by an internal spring. The upper ram of the double-acting presses is provided with depth stop nuts and collars to accurately regulate the stroke within the limits of the cylinder. The single-acting press has no upper ram or depth stop adjustment. Mounting bracket permits both vertical and radial adjustment. The table is machine surfaced but is left soft to enable the mounting of special tooling.

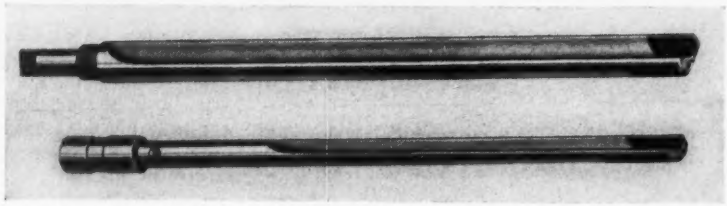
"Carboflex" Grinding and Cutting-Off Wheel

New depressed-center "Carboflex" grinding wheel announced by the Carborundum Company, Dept. M, Niagara Falls, N. Y. The glass fiber reinforced resin-bond design of this wheel is said to provide efficient operation with maximum

safety. The wheel is designed to combine fast cutting with high strength and resistance to cracking. It is adapted for rough-grinding, cutting-off, and slotting operations on ferrous and nonferrous metals as well as nonmetallic materials. Both sides of the wheel as well as the periphery can be used for cutting. The new wheel is available in 7- and 9 1/8-inch diameter sizes in thicknesses of 1/8, 3/16, and 1/4 inch with an arbor hole 7/8 inch in diameter. Grade A24-R-BC is recommended for metal applications and Grade C24-R-BC for use on non-metallic materials.

High-Capacity Valve for Relief Pressure Control in Oil Systems

High-capacity pilot type relief valve designed for constant relief pressure control in oil systems introduced by Fluid Controls, Inc., Dept. M, 1284 N. Center St., Mentor, Ohio. This valve has a small pilot valve that controls the action of a larger main valve. The valve is designed to hold the pressure constant regardless of the volume of fluid flow. The main valve is responsive to the oil flow only through the pilot and positions itself to maintain this pilot flow at a constant rate. Any change in pressure at the pressure point affects the pilot which, in turn, controls the main valve. Relief pressures are adjustable from 50 to 1000 or 500 to 3000 pounds per square inch. The capacity is 40 gallons per minute at a pressure of 200 pounds per square inch or greater.

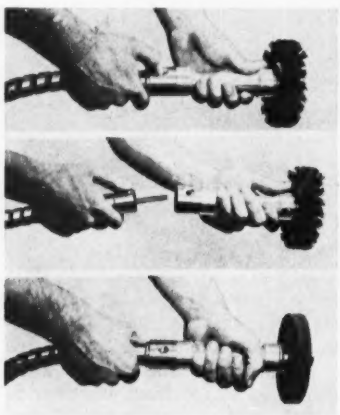


Carbide-Tipped Gun Drills for Deep-Hole Drilling

Two types of carbide-tipped gun drills—solid high-speed body and oil-tube body types—brought out by Whitman & Barnes, Dept. M, Plymouth, Mich. The solid high-speed body type is for use when the hole is comparatively shallow, while the oil-tube type is used when the hole to be drilled is very deep. In both cases, oil under pressure is used to cool the cutting lip and force the chips out of the hole. Gun drills can be used for hole depths from 4 to about 250 times the diameter of the hole. Either the drill or the work-piece can be revolved, and in some instances it is desirable to revolve both. Oil can be forced through the end of the shank or the side, depending upon the machine in use. These drills can be used in either the vertical or horizontal position, as required by the equipment available.

Quick Change Hand-Piece for Strand Flexible Shaft Machines

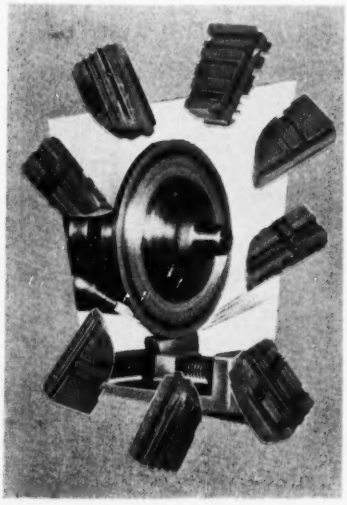
Quick-change hand-piece for Strand flexible shaft machines made by the Franklin Balmar Corporation, N. A. Strand Division,



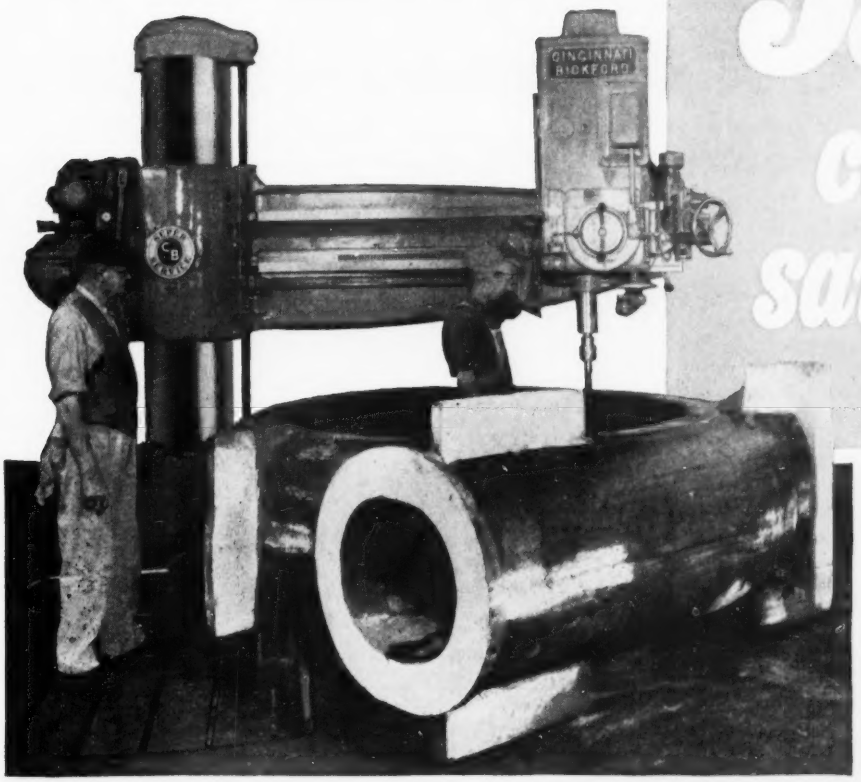
Dept. M, Woodberry, Baltimore 11, Maryland. No tools of any kind are required to change the working attachment at the end of the flexible shaft when using this hand-piece. The device is fitted with a spring lock retaining button. To change the hand-piece it is only necessary to press the button, pull the entire hand-piece and the permanently affixed tool away from the shaft, and snap a new hand-piece and tool in place. Thus, brushes, wheels, rotary files, and other flexible shaft tools are quickly available.

Improved Design of "Al-Aloid" Bonded Diamond Wheels

A line of diamond wheels bonded with "Al-Aloid" has been announced by the A.I.T. Diamond Tool Co., Dept. M, 646 W. Lake St., Chicago 6, Ill. Three features claimed for this bond are increased grinding speed, lengthened wheel life, and equalization of all tungsten carbides, thus placing them in the same class as ordinary steel. Plunge-grinding enables these wheels to remove from 0.005 to 0.062 inch in one pass. This bond has been perfected with an eye toward diamond conservation. With it, more cubic inches of carbide, per carat of diamond, are ground.



This BICKFORD effected a 35% cost saving!

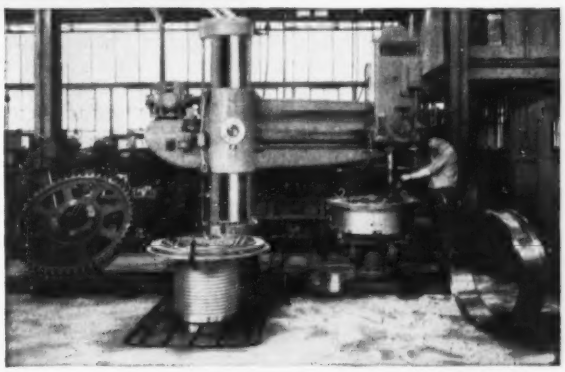


Drilling large centrifical dredge pump housing. This 7 arm, 19" diameter column Cincinnati Bickford Super Service, equipped with triple base, allows setup of two jobs while the third is in process.

The efficient drilling department at the National Supply Company of California effected a 35% cost reduction in drilling operations with this Cincinnati Bickford Super Service Radial Drill.

Here the many feeds and speeds of the Cincinnati Bickford Super Service Radial Drills—and their rigid construction—combined with their easy operation—handle a variety of heavy duty jobs with outstanding dependability at low costs.

Write for Booklet R-29 on these powerful, accurate Cincinnati Bickford Super Service Radial Drills.



Drilling and tapping a clutch housing. Note the second housing ready for drilling on one of the triple bases of the machine. No time lost in setup.

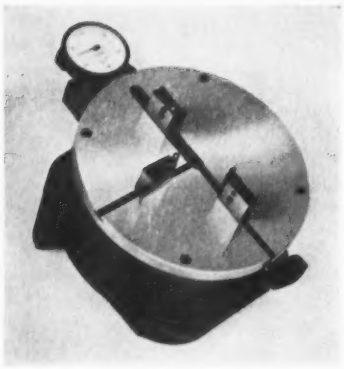
Photos—Courtesy of National Supply Co., Torrence, Calif.

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio U.S.A.



Acra-Ment Bench Comparator

K7-R bench comparator designed to accurately and quickly gage inside or outside diameters on short-run or production work. The illustration shows the T-plate type with adjustable inside diameter and outside diameter jaws, but the comparator is available with several other types of jaws made to specific requirements. This gage has a heavy surface-ground top plate supported by an extra heavy precision-machined base, and is equipped with fine adjustment to facilitate quick and accurate setting-up. Product of Acra-Ment, Gage Division of Myer Corporation, Dept. M, 633 Park Ave., Cranston, R. I.

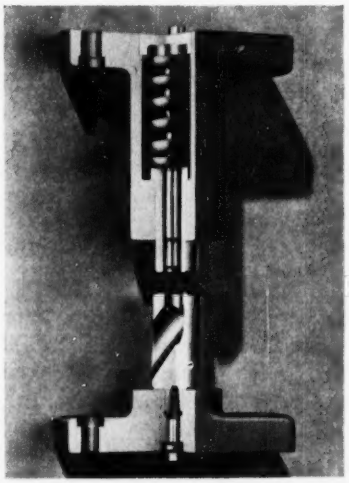
Federal "Eccentricator" for Checking Run-Out

Compact "Eccentricator," designed to eliminate the need for observing maximum and minimum indicator readings and computing the difference when measuring workpieces for eccentricity, announced by the Federal Products Corporation, Dept. M, 1144 Eddy St., Providence 1, R. I. This device can be

used, in special applications, for checking run-out, squareness, straightness, and wobble, while ignoring normal variations in size of different work-pieces. It is always used with suitable indicating power units (either electric or electronic) and is adjustable over a wide tolerance range. The instrument can be used for sorting to sizes with over- and under-size tolerance lights, or it can be employed on high-speed, completely automatic electronic gages to measure eccentricity, squareness, run-out, straightness, and wobble. Any number of Eccentricators can be mounted side by side either horizontally or vertically for multiple dimension gaging.

Wales Hole-Punching Unit

Wales Type "JD" hole-punching unit made by the Wales-Strippit Corporation, Dept. M, 345 Payne Ave., North Tonawanda, N. Y. These units are designed to punch mild steel up to 1/4 inch thick and may be used and re-used in an unlimited number of set-ups. Each punch assembly and die assembly is independent and self-contained.



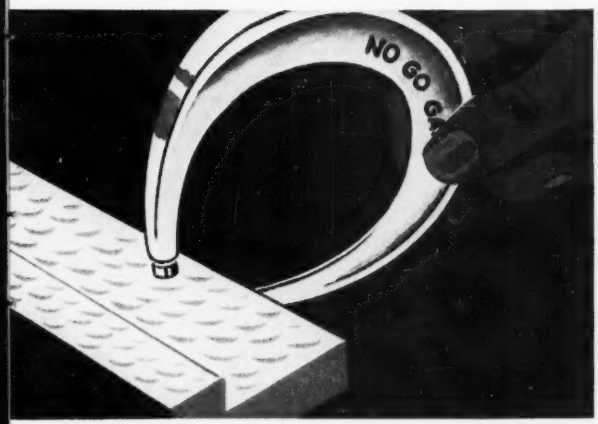
The punch assembly consists of holder, punch, stripping spring, punch guide, and pilot head. The die assembly consists of holder, die, and pilot-pin. These units provide for punching holes at practically any center-to-center distance over large and small sheets of material, the only limiting factor being the size of the die set or press. By using the template mounting method, changing set-ups only requires removing the pair of operating templates and replacing them with the next complete set-up. Thus set-ups made outside press are ready for use as soon as the templates are bolted in place.

Rotor Air Pencil Die Grinder

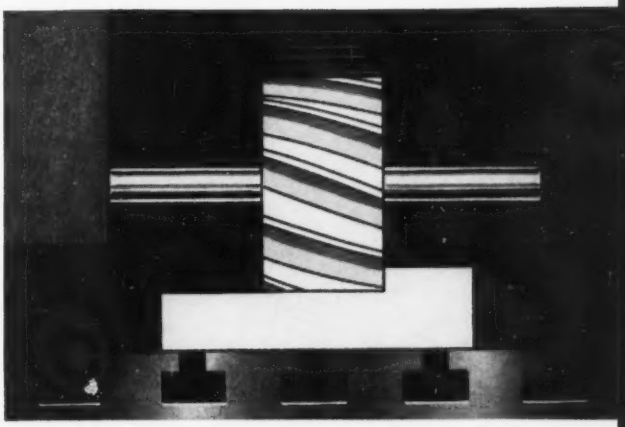
High speed D-03 air pencil die grinder announced by the Rotor Tool Co., Dept. M, 26300 Lakeland Blvd., Cleveland 23, Ohio. This grinder weighs 13 ounces, is 5 3/4 inches long, 1 inch in diameter, has a speed of 40,000 R.P.M., and can be furnished with a 1/8- or 1/4-inch collet. It is equipped with a three-bladed air motor—not a turbine—that provides power at high speed for the ball-bearing one-piece spindle under the control of a sliding sleeve control. A toolpost holder and steel heads without throttle are available.

HOW TO END DAMAGED WAYS, PRODUCTION LOSSES

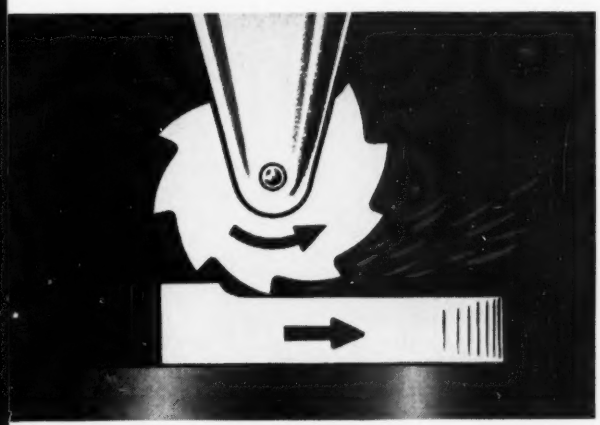
Sunoco Way Lubricant Stops "Jumpy Table"



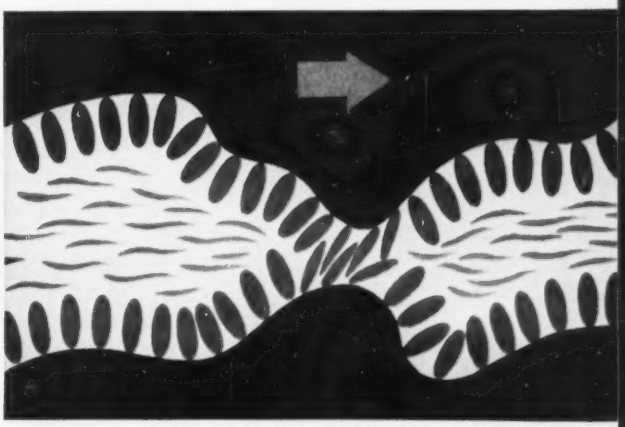
Tool chatter and jumpy table are machining headaches. Too often they cause poor surface finish, failure to hold tolerances, production losses.



Tool chatter is a result of a lack of rigidity in either the machine or the set-up. It is a mechanical problem and no lubricant can lick it.



Jumpy table is a stick . . . slip . . . stick . . . slip action of the table. It is a lubrication problem. Though just as damaging as tool chatter, it is not always detected when the cause of poor surface finishes.



Extreme magnification

Sunoco Way Lubricant cures jumpy table. It contains special compounds that form a film, like the nap of a rug, on the sliding surfaces and minimize the force of both static and kinetic friction.

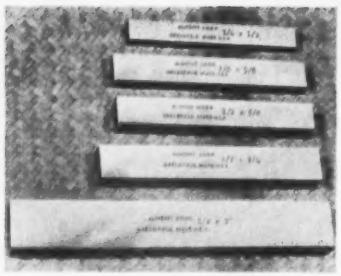
Why take a chance of damaging your ways? These integral parts of the base casting for your machine are difficult to refinish and costly to replace. For information about Sunoco Way Lubricant, call a Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-2.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

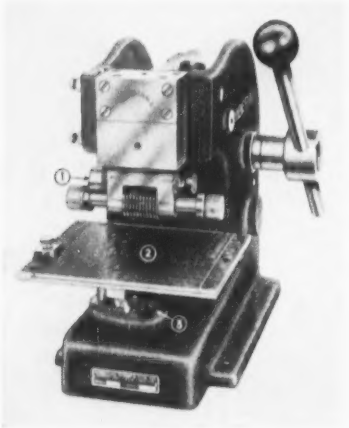


du Mont Rectangular Tool Bits

The du Mont Corporation, Dept. M, Greenfield, Mass., announces the addition of a complete standard range of super high-speed rectangular ground tool bits to their present line of square bits. The new rectangular bits are made of blended and balanced carbon and vanadium steel for fine grain structure. They are heat-treated to 66 to 68 Rockwell C and ground to close tolerances without carburization, and are adapted for a wide range of applications.

Bench Numbering Press

Light, compact press designed for stamping small nameplates and flat articles with up to 1/8-inch



high characters. This press weighs 65 pounds. It is hand-operated, a cam being used to obtain the required pressure. Having only three moving parts it is easy to maintain. Any numbering machine, automatic or non-automatic, type-holders with interchangeable steel type, or special dies can be operated in this press. Product of the Numberall Stamp & Tool Co., Dept. M, Huguenot Park, Staten Island 12, N. Y.

Hacksaw Attachment for Electric Drill

The Roto "Sabre Saw," manufactured by the Rotex Co., Dept. M, 835 W. Davis St., Dallas, Tex., is a hacksaw designed for industrial, commercial and home workshop use in conjunction with any 1/4-inch electric drill. The tool cuts through wood, plastic, sheet

metal, pipe, and plaster board. It is designed to take one stroke for each two revolutions of the drill to prevent burning the saw blade. All parts are hardened and ground alloy steel, machined to close tolerances. The tool is furnished with three blades—one for heavy wood, one for scroll work, and one for metal.

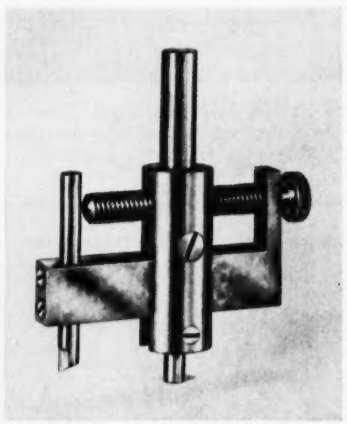
Small-Size Bench Press

Bantam size, air-oil combination hydraulic bench press capable of developing a pressure of 5 tons when connected to an air line having a pressure of 100 pounds per

square inch. The advantages claimed for this Model 500 "Pnudraulic" press are compactness, flexibility, and economy of operation. It weighs 300 pounds. An air filter protects the unit from damage caused by pipe scale and dirt in the air line. The press requires no electric power, pumps, or cooling water and is especially suited for staking, riveting, forming, piercing, crimping, sealing, broaching, trimming, marking, and flanging operations. This press is made by the Alliance Mfg. Co., Dept. M, Alliance, Ohio.

Micro Circle Cutter

Holes up to 15 inches in diameter may be cut in metal, plastic, or wood with a Micro circle cutter manufactured by the Precise Measurements Co., Dept. M, 942 Kings Highway, Brooklyn 23, N. Y. It has a built-in micrometer



type size adjustment for precise settings. Heavy construction of the main beam and body makes it useful for production as well as experimental work. The units come in 4-, 6-, 10-, and 15-inch sizes, all equipped with 1/4-inch high-speed steel cutting bit.

* * *

Forging High Nickel Alloys

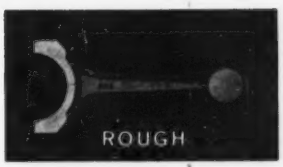
Because of their high strength, toughness and hardness, nickel alloys such as Monel and Inconel must be heated to much higher heat than most other non-ferrous metals during forging operations. It takes a temperature of about 2100 degrees F. or higher, depending on the alloy, to soften an ingot enough for forging by hammer.

Buhr

SPECIAL...

Drills, reams and chamfers 565 Connecting Rods an hour

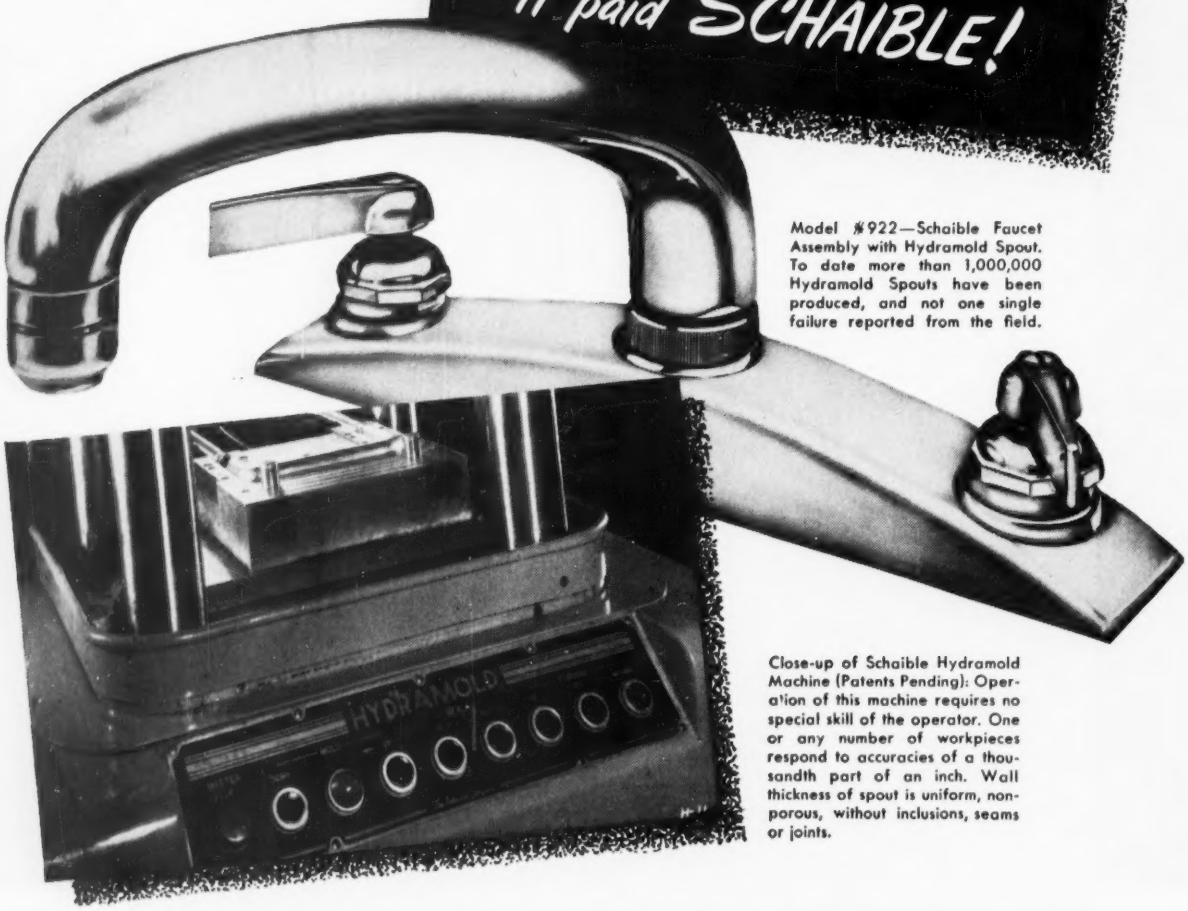
This Two-Column Automatic Drilling Machine
is arranged with tool-steel, laminated, hardened and ground ways.
Heavy-duty ball-bearing construction provided for all spindles.
The eight-station holding fixture is mounted
on 60″-diameter automatic Index Table.
Parts are manually loaded, hydraulically clamped and automatically ejected.
All installations comply with J.I.C. Standards.
Automatic lubrication throughout Machine.
Special safety features . . . Only one operator required.



BUHR MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

Buhr **MULTIPLE-SPINDLE HIGH PRODUCTION MACHINERY**

IT WILL PAY YOU TO LOOK INTO REVERE'S 70-30 BRASS TUBE— *it paid SCHAIBLE!*



Model #922—Schaible Faucet Assembly with Hydramold Spout. To date more than 1,000,000 Hydramold Spouts have been produced, and not one single failure reported from the field.

Close-up of Schaible Hydramold Machine (Patents Pending): Operation of this machine requires no special skill of the operator. One or any number of workpieces respond to accuracies of a thousandth part of an inch. Wall thickness of spout is uniform, nonporous, without inclusions, seams or joints.

A brass that does not have to be "tailored" to a job, but is made with accuracy in normal mill procedures, meets the unusual material requirements that the Schaible Company has in its remarkable spout fluid forming process called Hydramold.

The Schaible Company, Cincinnati, Ohio, is one of the larger manufacturers of strainers, valves and faucets, who have been more progressive in product design and methods of manufacture. Schaible requirements are exacting as to product quality control. This is especially true of sources of material, and when the company developed, designed and built its four new Hydramold machines to manufacture modern spouts from tubular material, the specifications became most rigid.

This was where the Revere Technical Advisory Staff entered the picture. Revere technical men studied the Hydramold process developed by Schaible engineers, and the unusual forming requirements, thereby helping establish the exacting specifications so that the mill and manufacturer developed mutual material control and process information.

The Schaible Company has made more than one million spouts by this new method without a single field performance failure—better spouts, states Schaible, produced by more economical means than conventional casting methods.

Today, there may be more costly spouts, but according to Schaible "There is no better spout than the Schaible Hydramold formed spout."

This case study is another example of the value of close cooperation between Revere and an exacting customer. The more we know about what you make, and how you make it, the better we can serve you. See the nearest Sales Office.

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PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Card below for further information
On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

TAP REFERENCE BOOK—Besly-Welles Corporation, Beloit, Wis. A new edition of the Besly tap reference book which contains the latest information on British-American Unified Thread Standards. Easy-to-understand explanation of the new standards for internal threading is included, as well as a tabulated comparison between Unified Thread forms and American Standard threads. Manual available when requested on a company letterhead sent to the above address.

HYDRAULIC COMPONENTS—Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Nine catalogues designed to simplify the planning of hydraulic circuits and the ordering of hydraulic components. The catalogues are as follows: No. 601—pumps, motors, and power units; No. 701—150 P.S.I. air or 300 P.S.I. oil hydraulic cylinders; No. 721—2000 P.S.I. cylinders; No. 741—3000 P.S.I. cylinders; No. 801—2000 P.S.I. valves, threaded connections; No. 821—3000 P.S.I. valves, flange connections; No. 841—3000 P.S.I. valves with gasket mountings; No. 901—accessories such as filters, gages, pressure switches, weld type flanges, heat exchangers, slip joints; No. 1001—H-P-M Engineering Manual containing wealth of information on hydraulics. 1

BALANCING MACHINES, ELECTRONIC—Tinius Olsen Testing Machine Co., Willow Grove, Pa. The Electodyne, a new principle for automatically measuring the amount of unbalance and indicating the angular location of unbalance by means of electronics, is comprehensively described in Bulletin 49. Features of the complete line of Olsen Electodyne dynamic and static balancing machines are also described. Horizontal and vertical models are covered, as well as the automatic crankshaft balancer. 2

AMPLIDYNE—General Electric Co., Schenectady, N. Y. Bulletin GEA-4053B comprising 23 pages of information pertaining to the functions and applications of the amplidyne which is essentially an externally driven direct current generator which employs a short circuit and compensating winding. A precise electrical balance is created so that the smallest electric signals release killowatts of output sufficient to control powerful machinery. 3

CARBIDE TOOLS, SINGLE-POINT—DoAll Co., Des Plaines, Ill. Carbide-tipped, single-point cutting tools of various types, such as straight-turning, lead-angle turning, pointed-nose, threading, end-cutting and side-cutting offset, and square nose are covered in a 12-page brochure. Standard unground carbide tips, as well as carbide tips for threading tools, reamers, and scrapers are also shown. Carbide tips for lathe and grinder centers are listed. 4

PRECISION CYLINDRICAL GRINDERS—Landis Tool Co., Waynesboro, Pa. Plain and roll grinders of 18- and 24-inch sizes covered in Catalogue F-53 which comprises 20 pages of photographs, sketches, and specifications. The machines are equipped with pressure-lubricated Microsphere wheel-spindle bearings and are provided with a hydraulic table traverse, V-belt drives, automatic way lubrication, and built-in electrical equipment. 5

NEEDLE BEARINGS—Torrington Co., Bantam Bearings Division, South Bend, Ind. Catalogue 61, descriptive of heavy-duty needle bearings. Particularly helpful to designers and engineers are numerous pages of cross-sectional drawings that show details of typical installations. Design features, bearing selection, sealing, lubrication, and tables listing speed, life factors and capacities are included. Hardness factors are conveniently charted. 6

HEATERS AND HEATING DEVICES—General Electric Co., Schenectady, N. Y. Catalogue GEC-1005E, describing the features and applications of a wide range of Calrod electric heaters and heating devices. This 60-page booklet provides the answers to hundreds of small heating problems that daily puzzle electrical engineers, superintendents, foremen, shop owners and maintenance men. Simple installation instructions are provided. 7

ABRASIVE SNAGGING WHEELS—Simonds Abrasive Co., Philadelphia, Pa. Four-color brochure Form ESA-62 with unusual typography presents information relating to abrasive snagging wheels for steel mills and foundries. It contains the latest grinding-wheel recommendations for various materials including titanium alloy, and data relating to Red Streak flanges built into the grinding wheels to provide a steel-against-steel fit with mounting flanges. 8

HIGH-TEMPERATURE ALLOYS—Firth Sterling, Inc., Pittsburgh, Pa. Bulletin 301, describing the following five grades of high-temperature alloys: Discaloy, 16-25-6, A-286, 19-9-DX, and Greek Asculoy. Typical analyses, characteristics, applications, machining information, and forging instructions are provided. These alloys cover a high stress operation field at temperatures ranging from approximately 800 to 1400 degrees F. 9

PIPELESS METAL-WORKING PRESSES—American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. Bulletin 1011, with 6 pages of illustrations and descriptions pertaining to pipeless metal-working presses. All high pressure fluid is conducted through short, direct passages drilled in the structural members of the presses. Low cost maintenance is stressed. 10

SURFACE GRINDERS—Reid Brothers Co., Inc., Beverly, Mass. Brochure 618-53, describing a complete line of 6- by 18-inch precision surface grinding machines. Specifications and dimensions are included. Operating features described include finger-tip lever controls, cartridge-type motorized spindle and hand-scraped ways for precision operation and convenience in the tool-room. 11

SPEED CONTROLS—Reeves Pulley Co., Columbus, Ind. Bulletin G-537, covering the complete line of automatic controls available for Reeves variable-speed drives. The 24-page booklet describes means of solving problems involving the control of tension, acceleration, deceleration, velocity and peripheral speed, as well as synchronization of one or more machines and methods of maintaining uniform temperature, pressure, liquid level, and flow. 12

CARBIDE REAMER SHARPENING—Staples Tool Co., Cincinnati, Ohio. Shop manual providing data for the sharpening and conditioning of carbide-tipped reamers. The manual supplies data on chamfer sizes, recommended clearance angles, proper method of repairing outside diameters and flute faces, special sharpening techniques for specific applications, and recommended diamond wheel types and sizes. 13

TANGENT BENDING SEQUENCE PRESSES—Cyril Bath Co., Solon, Ohio. Catalogue dealing with the tangent bending process used in forming metal cabinets for refrigerators, washers, dryers, and other electrical appliances. Twenty-eight pages show many applications and describe four types of tangent banding sequence presses which operate at production speeds as high as 300 parts per hour. 14

SPEED REDUCERS—Philadelphia Gear Works, Philadelphia, Pa. Catalogue of 16 pages, describing improved planetary speed reducers. These in-line reduction units are available in single, compound, and double types with horsepower ratings in AGMA Class 1. Standard ratios range from 4.3 to 1 up to 106 to 1. Construction details, diagrams and selection tables are supplied. 15

BENCH AND PEDESTAL LATHES—Clausing Division, Atlas Press Co., Kalamazoo, Mich. Circular describing heavy-duty, 12-inch, 5300 series of bench and pedestal type lathes of a 1-inch collet capacity. Construction features are described, such as an exclusive friction clutch and brake countershaft. Complete specifications are presented. 16

ALUMINUM MILL PRODUCTS—Reynolds Metals Co., Louisville, Ky. Brochure containing data concerning characteristics of aluminum; standard alloys; and tempers and sizes of aluminum sheet, plate, wire, rod, bar, tubing, pipe, and extruded and architectural shapes. Also included is a selection guide for wrought and cast alloys. There are suggestions for fabricating and finishing. 17

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HYDRAULIC PRESSES AND EQUIPMENT—R. D. Wood Co., Philadelphia, Pa. Brochure describing hydraulic presses and equipment in the metal-working, rubber, plastics, and wood-working industries. Basic hydraulic press specifications are supplied as well as descriptive material pertaining to high-pressure hydraulic valves, hydraulic accumulators, and hydraulic shock alleviators. 18

MACHINE TOOL AUTOMATION—Turchan Follower Machine Co., Detroit, Mich. Automatic control systems for machine tools and automatic servo-controlled machine tools discussed in 24-page brochure. Controls for vertical turret lathes, milling machines, shapers, planers, and other machine tools illustrated and described. 19

BROACH AND GEAR SHAVING TROUBLE-SHOOTING CARD—National Broach & Machine Co., Detroit, Mich. Two-color wall card, 8 1/2 x 11 inches, listing broach troubleshooting and gear-shaving check points. A metal eyelet facilitates wall mounting in production and engineering departments. The tool, workpiece, machine, and coolant are considered. 20

PEDESTAL TOOL GRINDER—South Bend Lathe Works, South Bend, Ind. Catalogue 5328, describing recently introduced pedestal tool grinders designed for easier off-hand grinding. Chief design improvements include an interior mounted and protected motor, wheel weight taken off motor bearings, and large eye shields with built-in lighting. 21

COLLETS AND STEP CHUCKS—Rivett Lathe & Grinder, Inc., Boston, Mass. Bulletin 100E, listing the collets and step chucks required for the various sizes and makes of standard machine tools. All data and specifications are conveniently arranged for quick reference. Mounting instructions are supplied. 22

STRAIN GAGE—Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Bulletin 4207, dealing with an improved Whittemore strain gage. This gage is employed for the stress analysis of specimens and engineering structures. Bulletin describes construction features and application advantages. 23

BROACHING—Colonial Broach Co., Detroit, Mich. Bulletin commemorating the thirty-fifth anniversary of the concern which treats the past, present, and future of broaching. A list is included of literature available on broaching machines, hydraulic assembly presses, hydraulic straightening presses, hydraulic broaching presses and broach sharpeners. 24

DIAL INDICATORS—Chicago Dial Indicator Co., Chicago, Ill. Dial indicators, bench gages, snap gages, and various accessories necessary for precision instruments used by machinists, toolmakers, and inspectors, are described in General Catalogue 106. Continuous reading dial for 0.001, 0.005, and 0.0001 inch graduations is featured. 25

WET BLASTING MACHINES—American Wheelabrator & Equipment Corporation, Mishawaka, Ind. Model 30 Liquamatic wet blasting machine illustrated and described in Bulletin 93. Typical applications are heat-treat scale removal, fine deburring, blending of grinding lines, finishing and redressing of dies and surfacing of tools. 26

TOOL-ROOM ACCESSORIES—Vlier Engineering, Inc., Los Angeles, Calif. Catalogue 53, describing considerable variety of tool-room accessories for jigs, fixtures, and dies. Such products are described as spring plungers, fixture keys, spring stops, toggle pads, and torque thumb screws. 27

PNEUMATIC THERMOMETER CONTROLLER—Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Bulletin 6401 which illustrates and describes features and applications of pneumatic thermometer controllers that are applicable to a wide range of operations including electroplating, degreasing, cooling, drying, and heating. 28

VAPOR SPRAY DEGREASER—Metalwash Machinery Corporation, Elizabeth, N. J. Vapor spray degreaser of improved design described in 4-page bulletin. Features include unobstructed tank walls, unit water separator and pump chamber, and demand-type water control. Simplified maintenance is cited as an advantage. 29

PRESS ROOM EQUIPMENT—Durant Tool Supply Co., Providence, R. I. Bulletin dealing with such equipment as roll feeds, stock reels, coil cradles, stock oilers, foot presses, scrap choppers, wire straighteners, and stock straighteners. Specifications are provided for various sizes in the different models. 30

SHOP STOOLS AND CHAIRS—Standard Pressed Steel Co., Jenkintown, Pa. Bulletin 704-4, describing fourteen models of steel stools including knock-down, adjustable, filing and revolving-seat stools, and three chairs. Seats are made of steel, presdwood-covered steel, round wood and shaped plywood. 31

SHEET-METAL ROLLERS—O'Neil-Irwin Mfg. Co., Lake City, Minn. Circular pertaining to Di-Acro rollers built in eight models for forming metal up to 42 inches in width. Various rolling techniques are described and illustrated graphically. Other products are illustrated. 32

SPRINGS—Producto Machine Co., Bridgeport, Conn. One-page insert for No. 10 catalogue describing a new line of medium-pressure diemakers' springs of the 50 per cent deflection, oval wire type. These springs are stocked for the first time. 33

MICROFINISH COMPARATOR—Baptist Machine Co., Stamford, Conn. Circular describing S22 Microfinish comparator made by electroforming which provides flat-surface roughness specimens for visual and tactual comparison. Comparator furnishes an easy means of determining surface roughness. 34

DRILL PRESS TURRETS—Howe & Fant, Inc., South Norwalk, Conn. "The Flying Dutchman" positive drive now incorporated in all Model E Lign-o-matic drill press turrets is described in Bulletin 5312. The positive drive is powerful enough for tools held in ½-inch chucks. 35

WELDING ELECTRODE HOLDERS—Cam-Lok, Division of Empire Products, Inc., Cincinnati 36, Ohio. Circular describing Cam-Lock welding electrode holders designed for cool and easy operation. Two models, each of which takes electrodes up to 1/4 inch diameter. 36

DOUBLE-END BORING, MILLING, AND CENTERING MACHINES—Walter P. Hill, Inc., Detroit, Mich. Double-end machines for boring chamfering, burring, milling, centering, flaring, and spinning on either solid or tubular round stock, described in a 2-page catalogue sheet. Description of hydraulic power head included. 37

COLD-DRAWN SEAMLESS TUBING—Columbia Steel & Shafting Co., Pittsburgh, Pa. Sizes, working pressures, and other specifications on all types of Summerill tubing presented in 8-page booklet. Tubing for hydraulic pressure, mechanical, Diesel, and aircraft applications especially featured. 38

HEAT-TREATING—Metal Treating Institute, New Rochelle, N. Y. Folder entitled "Heat Treaters Cite Short Cuts to More Effective Purchasing," containing information as to proper specifications on purchase orders. It eliminates the need of comprehensive metallurgical knowledge. 39

DESEGATIZED HIGH-SPEED TOOL STEELS—Latrobe Steel Co., Latrobe, Pa. Bulletin describing the characteristics and properties of XL Desegatized high-speed tool steels. Various types are mentioned and also the different shapes in which the steels can be supplied. ..40

DECIMAL EQUIVALENT CARD—South Bend Lathe Works, South Bend, Ind. Red and black decimal equivalent card, measuring 3 3/8 by 5 1/2 inches which lists the decimal equivalents of fractional parts of an inch to six places. ..41

MICROCOMPARATOR—Cleveland Instrument Co., Cleveland, Ohio. Bulletins 535 and 536, describing electronic Microcomparators. One model is regularly furnished to read to one-half millionth of an inch. Full constructional data and specifications are given. 42

HARDNESS TESTING MACHINES—Steel City Testing Machines, Inc., Detroit, Mich. Brinell hardness testing machines of several types are covered by Bulletin B953. Various accessories are also described. Complete specifications are given. 43

POWER PRESSES—General Mfg. Co., Detroit, Mich. Bulletin 401, describing Flexible-Power presses of various models, as well as accessories, such as bending blocks, carriage heads, dial indicators, and live ball-bearing centers. 44

MACHINE MOUNTING PADS—Felters Co., Boston, Mass. Booklet containing questions and answers pertaining to Unisorb mounting pads used to reduce vibration and noise in the installation of a wide variety of machinery. 45

TAPPING SCREWS—Townsend Co., New Brighton, Pa. Booklet TL-88, dealing with a variety of thread-cutting screws for screwing or hammering into sheet metal, plywood, structural steel, castings, forgings, plastics, and other materials. 46

PRESS BRAKES—Verson Allsteel Press Co., Chicago, Ill. Circular describing standard press brakes now available from stock. Press 1062 has a capacity of 25 tons and Press 16-48, a capacity of 15 tons. 47

DIAL-INDICATOR CONTACT POINTS—Precision Supply & Machine Co., Fair Lawn, N. J. Circular describing sapphire, tungsten-carbide, and diamond-tipped contact points for dial indicators. 48

PUNCH PRESSES—Kenco Mfg. Co., Los Angeles, Calif. Folder illustrating the company's line of 4-and 5-ton punch presses, swivel base vises, and rotary tables. 49

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

Circle numbers of the catalogue items in which you are interested.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49											

For more details on products mentioned in the editorial pages or shown in the advertisements in this issue, fill in below:

PAGE .....PRODUCT .....

PAGE .....PRODUCT .....

Please print your name and address

YOUR NAME .....TITLE .....

COMPANY .....

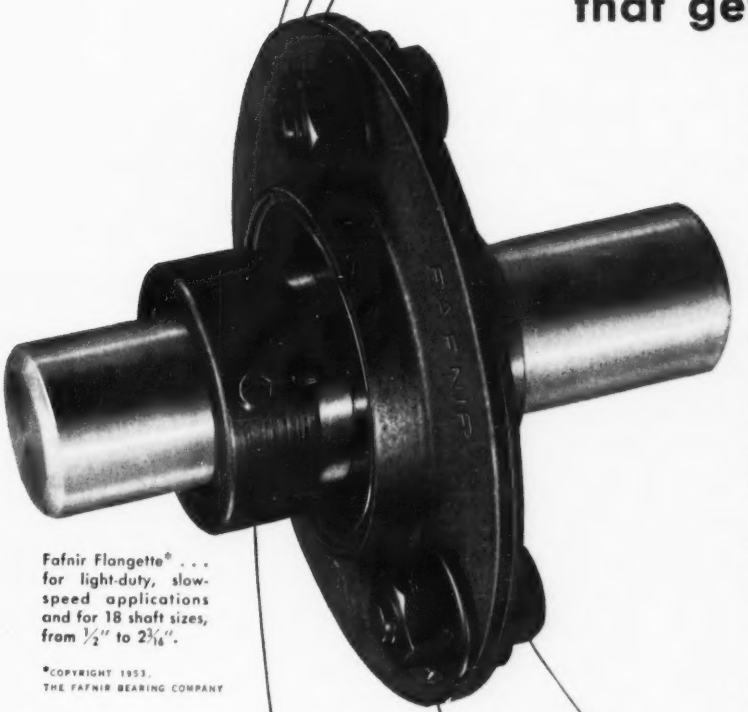
CO. ADDRESS .....

CITY .....ZONE.....STATE.....

This card is void after May 1, 1954 M-2/54

Design Strategy

that gets more for less



Fafnir Flangette* . . . for light-duty, slow-speed applications and for 18 shaft sizes, from ½" to 2 3/16".

*COPYRIGHT 1953, THE FAFNIR BEARING COMPANY

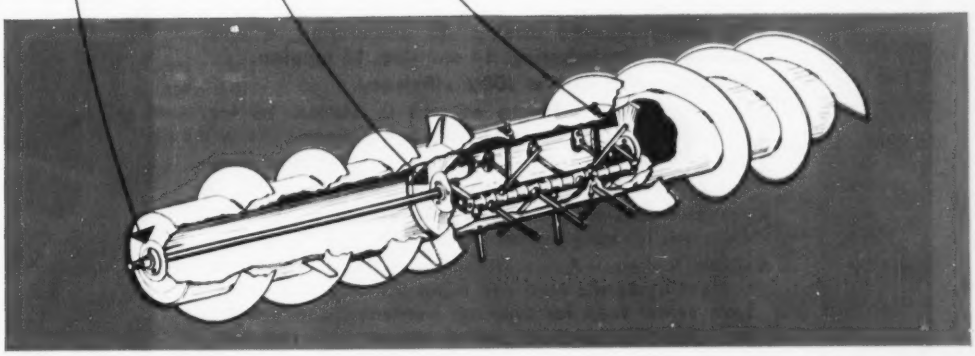
By installing Fafnir Flangettes on the loading auger shaft of a self-propelled combine, a manufacturer of farm equipment improved auger performance and reduced manufacturing costs at the same time.

Equipped with Fafnir Ball Bearing Flangettes, the auger required less power to operate, no re-lubrication, no bearing adjustments and its service life was extended substantially. In addition, whenever servicing of auger parts required disassembly and reassembly, Fafnir Flangettes saved important man-hours.

From a manufacturing angle, Fafnir Flangettes eliminated the need for fabricating bearing housings with attendant lubricating systems.

They have their *own* easily applied housings—paired pressed steel flanges, which enclose a self-aligning Fafnir Wide Inner Ring Bearing with Self-Locking Collar—easiest of all bearings to install.

The mated eccentric cam design of the bearing inner ring and collar provides positive locking action without set screws, locknuts, or adapters — eliminates shaft slippage or scoring. Efficient seals keep grease in — contaminants out.

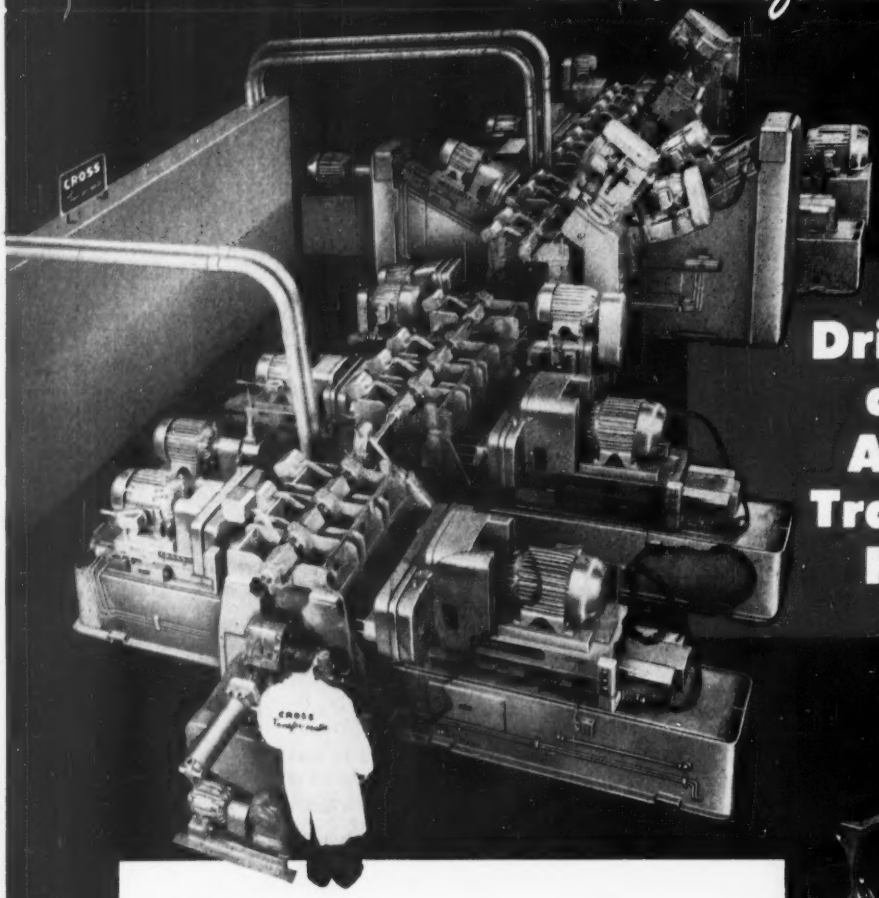


Here is another result of the Fafnir "attitude and aptitude," a way of looking at bearing problems from the designer's viewpoint . . . an ability for supplying the right bearing to fit the need. Maybe this combination can help you solve a bearing problem. The Fafnir Bearing Company, New Britain, Conn.

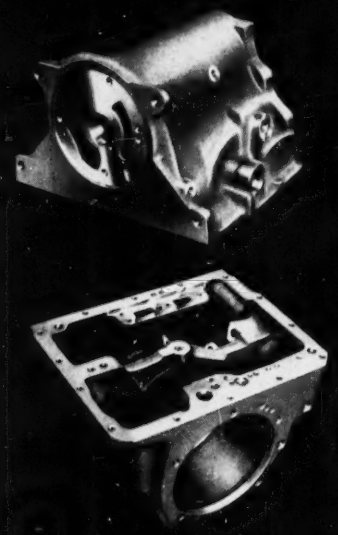
FAFNIR
BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Another Transfer-matic by Cross



Drills, Reams and Taps Automatic Transmission Housings



★29 stations.

★78 operations—30 drilling, 12 chamfering, 4 end milling, 3 counterboring, 14 reaming, 15 tapping.

★100 pieces per hour at 100% efficiency.

★Automatic 90° indexing of part in station 14 for drilling sides and top in subsequent stations.

★Pre-set tools and Cross Machine Control Unit with Toolometers for programming tool changes.

★Complete interchangeability of all standard and special parts for easy maintenance.

★Other features: Automatic transfer from station to station; hydraulic feed and rapid traverse; individual lead screw feed for tapping; hardened and ground ways; gravity operated cam clamping; J.I.C. standard construction; built-in chip conveyor.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 243

Between Grinds

By E. S. Salichs

For the Esquire Engineer

A handbook for building, repairing, and servicing farm equipment was just sent to MACHINERY for review—the thought being that although agriculture is not our field, many of our readers might own farms. (*Farm Arc Welding*, published by the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio; price, $2.)

Valves vs. Violets

As air cargo for the United Air Lines in 1953, machines and machine parts topped the list for the third year in a row. Cut flowers came in second, understandably so, since the ranking is made by total weight.

Fish Catches Angler?

To guard employes against "angling" for security information by unauthorized persons, the Minneapolis Honeywell Regulator Co. has successfully tried a card mailing program to employes. The nine most flagrant security risks are portrayed as fish. For example, there is the Fried Herring, the three-martini worker who unwittingly volunteers facts while imbibing; the Large-Mouthed Bass who loudly discusses classified information over the telephone; and the Common Carp who complains incessantly over security regulations. In each instance, the card reveals typical leading conversation-starters used by the angler.

Bud and His Bow

Fifteen minutes after the official opening of the archery deer season last fall near Gaylord, Mich., MACHINERY'S advertising representative "Bud" Wynkoop and a pal did simultaneously shoot arrows into the air and slay two bucks—which they later learned were the first and second deer recorded in Michigan for the season. Both were novices at the sport and their most unusual luck (according to old-hand Toxophilites, as they are known—from the Greek *toxon*, bow) has made them enthusiastic field archers.

Better to be Cold than Thirsty

Ethyl News tells us that one hundred years ago there were just two things you could do with petroleum—drink it and burn it.

Agility vs. Avoirdupois

Workmen at Wyman-Gordon Co. in North Grafton, Mass., are hopping on bicycles to get from one plant to another.

A Natural?

At the turn of the year, the president of the Gas Appliance Manufacturers Association, Sheldon Coleman, summed up the outlook of the gas appliance industry—B-T-U-tiful.

THE PROOF IS IN THE PLAQUE—that physical handicaps are not job handicaps. The Brown & Sharpe Mfg. Co., Providence, R. I., employs 400 physically handicapped veterans. Henry D. Sharpe, Jr. (left), president of Brown & Sharpe, is here seen receiving an American Legion citation from Robert F. Bergeon (right), department commander, as John F. Radikin (center), department employment chairman, assists at the ceremony which recognizes the company record.

News OF THE INDUSTRY

California

E. W. BLISS CO., Canton, Ohio, has leased a manufacturing plant at San Jose, Calif., in order to improve its service to the western metal-working industry. The 62,500-square foot factory is equipped to manufacture and repair all Bliss products, except the largest metal-working presses and rolling mills, and will carry a complete stock of standard parts for Bliss-built presses. Die sets and supplies manufactured and distributed by the Bliss subsidiary, the Die Supply Co., Cleveland, Ohio, will also be maintained.

COLONIAL BROACH CO., Detroit, Mich., announces the establishment of a West Coast manufacturing affiliate, the COLONIAL WESTERN BROACH CO., Los Angeles, Calif., in cooperation with the DEMCO TOOL CO., INC., also of Los Angeles, which will handle exclusively the new company's sales. Operations of the company will be under the direction of PETER STARMAN, manager, who is also president of the Demco Tool Co., Inc. The affiliate will serve the states of Washington, Oregon, California, Idaho, Arizona, and Nevada.

Illinois

WEAVER E. FALBERG has been appointed assistant general manager of sales for the sixteen steel service plants of Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. Falberg, who was formerly manager of the Alloy Steel Division, will have his headquarters in Chicago. Also announced was the appointment of ROLAND W. BURT as manager of the Chicago plant, a newly created position. Mr. Burt was formerly sales manager there, this position now being filled by ALFRED J. OLSON, who was assistant sales manager at the time of his promotion.

EDWARD C. LOGELIN is succeeding ARTHUR C. WILBY, who has retired, as vice-president of the United States Steel Corporation in Chicago, Ill. Mr. Logelin joined United States Steel in 1930. In 1946, he was named director of public relations for the Chicago district.

BURG TOOL MFG. CO., Los Angeles, Calif., announces the opening of the BURGMASTER MACHINERY CO., to be devoted to the sales and service of

R. A. Gorman, who is managing the Burgmaster Machinery Co.

Burgmaster products in the Midwestern states, including Illinois, Indiana, Missouri, Iowa, Kansas, Nebraska, Minnesota. The office is located at 5329 Lincoln Ave., Chicago, Ill. The new company will be under the management of R. A. GORMAN.

WHITING CORPORATION, Harvey, Ill., has assigned four additional sales engineers to its district offices: WILLIAM C. ESCH, to the Cincinnati, Ohio, office; PAUL SCHNACKENBERG, to the Houston, Tex., office; BYRON M. HOSKINS, to the Philadelphia, Pa., district, the office being located at Ardmore; and W. G. RAWSON, to the Seattle, Wash., office.

UDYLITE CORPORATION, Detroit, Mich., announces the opening of a new warehouse at 310 Market St., Rockford, Ill. The facility will service firms in the area with metal-plating and finishing supplies under the supervision of DAVID B. STOCKTON, resident sales engineer.

ROBERT E. WOLFF, who was assistant marketing manager, has been promoted to marketing manager of the tool and machine division of the Illinois Tool Works, Chicago, Ill. He has been with the company since 1941.

MUHAMMAD ABDUR RASHID has been added to the metallurgical staff of the Lindberg Steel Treating Co., Melrose Park, Ill. CARL MEINHARD has joined the company's research staff.

A. R. FICKER has joined the Rockford Clutch Division of the Borg-Warner Corporation, Rockford, Ill., assuming the position of director of advanced engineering.

Kansas, Minnesota, and Wisconsin

DOUGLAS C. ALBRIGHT is now associated with the Coleman Co., Inc., manufacturer of gasoline appliances and air-conditioning equipment, Wichita, Kans., in the capacity of works manager. Mr. Albright has had extensive experience in the design and production of precision cutting tools, automotive parts, and aeronautical products.

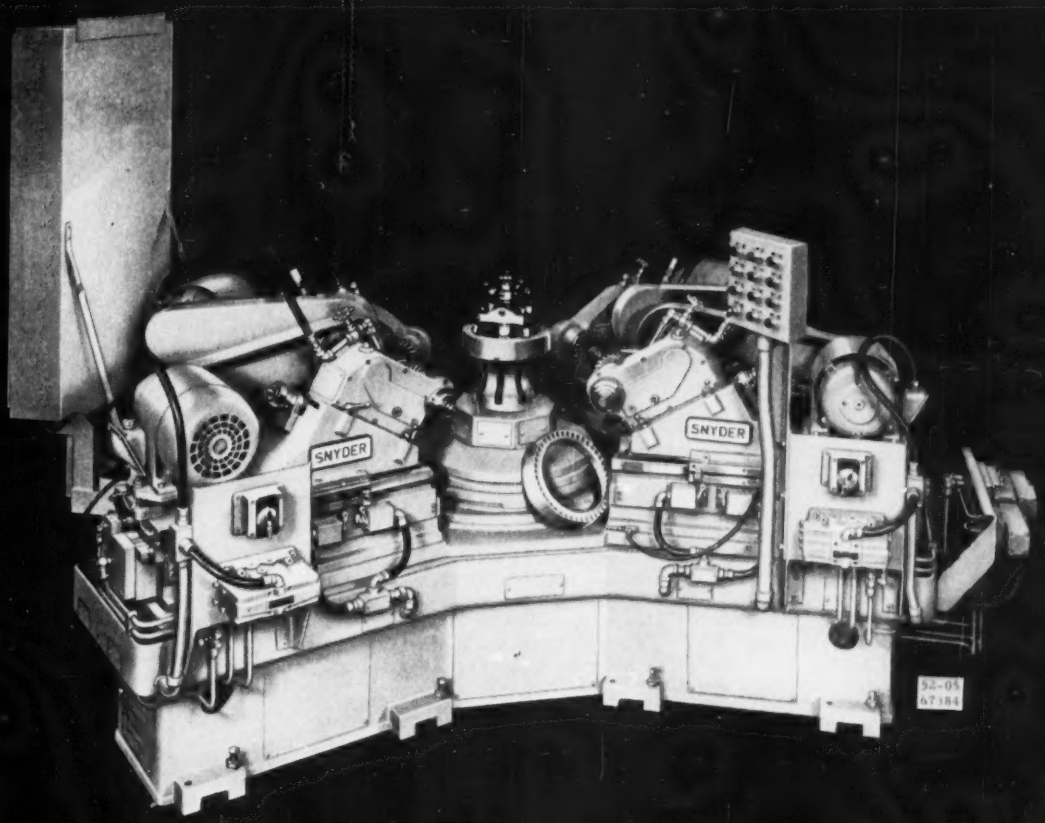
FICKE ENGINEERING & SUPPLY CO., 305 Pattie Ave., Wichita, Kans., has been appointed representative by RIVETT LATHE & GRINDER, INC., Boston, Mass., for the Rivett line of air and hydraulic valves, cylinders, and power units.

HARVEY VOGEL MFG. CO., metal stampings fabricator, formerly located at 1000 Raymond Ave., St. Paul, Minn., has recently moved to larger quarters at Como Ave. and the Minneapolis city limits, after remodeling a building formerly occupied by the American Farm Machinery Co. The new facilities consist of 25,000 square feet of space.

JOSEPH T. RYERSON & SON, INC., steel service organization, has begun operations in its new Milwaukee, Wis., plant at 500 S. 88th St. The facility has approximately four times the capacity of the old Milwaukee plant, and will serve Wisconsin, upper Michigan, and part of Canada.

Michigan

CARBOLOY DEPARTMENT OF GENERAL ELECTRIC CO., Detroit, Mich., has named three sales district managers—HARRY H. JASON becomes manager of the newly created New England district with headquarters at Wellesley, Mass.; and J. D. KENNEDY and ALFRED M. THOMSON, JR., become managers of the new South Central district, at St. Louis, Mo., and the East Central district, at Cleveland, Ohio, respectively. For-



NEW **SNYDER** AUTOMATIC

MILLS **8** SLOTS

IN CAST ALUMINUM ALLOY RING

EVERY **50** SECONDS

AT **80%** EFFICIENCY

SNYDER

TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan

29 Years of Successful Cooperation with Leading American Industries

merly, Mr. Jason was manager of tool sales, Mr. Kennedy was manager of product projects, and Mr. Thomson was a sales representative. WILLIAM S. BAKER, who was manager of the East Central district, has been named manager of tool sales. C. W. POWELL, formerly manager of the Pittsburgh, Pa., sales office, has assumed the same post in the newly created Allegheny, Pa., district. Under a $1,000,000 expansion program to be completed late in 1954, Carboloy will add 36,000 square feet of floor space to its metals building, as well as new engineering and manufacturing equipment.

MORTON MFG. CO., Muskegon Heights, Mich., announces the following personnel changes: ROBERT E. MORTON, vice-president and general manager of the Welding Division; JAMES H. MORTON, vice-president and assistant manager of the Welding Division; JACK E. MORTON, assistant secretary and purchasing agent; THOMAS H. MORTON, assistant treasurer and manager of the Machine Key Division; OREN G. RUTEMILLER, manager—sales and engineering; SHERWOOD BASCH, acting chief engineer; KENNETH OSLUND, chief engineer, Welding Division; and HAROLD LARSEN, production manager, Welding Division.

WILLIAM F. ROCKWELL has been named sales manager of the new East Central division of the Lufkin Rule Co., Saginaw, Mich. He has served as assistant sales manager at the home office since 1948. D. F. OLTZ has been made sales manager of the new West Central division. He joined the Lufkin sales force in 1951. THOMAS W. WISE has become assistant to the vice-president of the company, E. H. MEIBEYER.

C. D. TUCKER has been named production superintendent of the Bay City Division of the Dow Chemical Co., Midland, Mich. He will be in charge of magnesium fabrication, including the magnesium foundry and the machine shop. C. E. LEHNHARDT, the former superintendent, becomes product sales manager for magnesium fabrication.

THEODORE C. KOCH, vice-president in charge of manufacturing for the Ace-Central States Machine Tool Co., Detroit, Mich., has been promoted to the position of general manager. In addition to this post, Mr. Koch, will continue as vice-president of the Ace Tool & Die Co., also of Detroit.

MADISON INDUSTRIES, INC., Big Rapids, Mich., has purchased the gun drill manufacturing facilities of the Conner Tool & Cutter Co., Detroit, Mich. The Big Rapids company, which is also affiliated with the Madison Mfg. Co., Muskegon, Mich., is now in full production in its new plant.

DAN D. FELSKE has been appointed vice-president in charge of sales of the Gear Grinding Machine Co., Detroit, Mich. Mr. Felske has been with the company for the last thirty-three years, serving in sales, management, and manufacturing capacities.

CADILLAC GAGE CO., Detroit, Mich., has recently opened a modern plant at 25760 Groesbeck Highway. In addition to the increased machining capacity, a new chromium plating department has been provided.

PRODUCTO CORPORATION, Detroit, Mich., supplier of die sets and diemakers' equipment to the tool and die industry in the Midwest, has moved to a new building at 10200 Capitol Ave., Oak Park, Mich.

IRA S. LATIMER CO., 10600 Puritan Ave., Detroit, Mich., has been appointed to represent the steel division of HENRY DISSTON & SONS, INC., in eastern Michigan and northwestern Ohio.

LESTER J. BLACKFORD has been appointed general sales manager of the Progressive Welder Sales Co., Detroit, Mich. Mr. Blackford was formerly in charge of the company's Viking Sales Division.

EDWARD FRANK has been placed in charge of the new Michigan sales office of Titeflex, Inc., at 1249 Washington Blvd., Detroit.

HOWARD & SMITH, INC., distributor of machine tools, announces its transfer to a new building at 22524 Woodward Ave., Detroit, Mich.

New York and New Jersey

WILLIAM J. DURING has been elected president of the Precision Castings Co., Inc., Syracuse, N. Y. The retiring president, ARTHUR G. CHASE, has been re-elected chairman of the board. Prior to his election as president, Mr. During was executive vice-president, and in his long association with the company he has held positions as chief engineer, vice-president, and general manager.

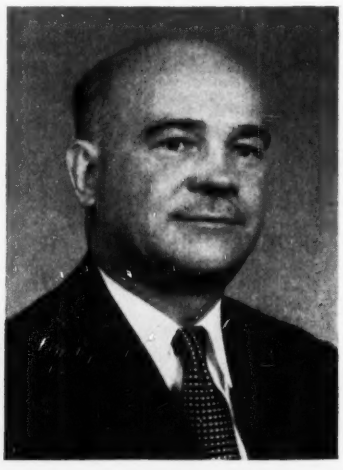
JOHN T. CASTLES is the new manager of the technical service unit of the silicone products department of the General Electric Co. at Waterford, N. Y. The unit was recently transferred from the engineering to the marketing section of the department. ROY W. HILL and JOHN B. HINDS, JR., have been named phenolic products sales representatives at the Chicago, Ill., office of the company's chemical materials department, which is located at Pittsfield, Mass.

CARBORUNDUM CO., Niagara Falls, N. Y., has reached an agreement with the STUPAKOFF CERAMIC & MFG. CO., Latrobe, Pa., for Carborundum to acquire the capital stock of Stupakoff. The Stupakoff concern manufactures ceramic components, seals, and printed circuits for the electrical and electronics industries. The newly acquired company will continue operations under its present name and organization.

R. J. COLVIN, Syracuse, N. Y., representative of Oakite Products, Inc., New York City, manufacturer of industrial cleaning materials, recently received the 1953 D. C. Ball award for exceptional service to industry, an annual Oakite award.

J. M. WELDON has been transferred to the general sales department of the International Nickel Co., Inc., New York City, as assistant to the vice-president. C. J. BIANOWICZ has been named manager of the Inco nickel alloys department, and DANIEL W. MACHON has been placed in charge of

William J. During, newly elected president of the Precision Castings Co., Inc.



C. J. Bianowicz, manager of the nickel alloys department of the International Nickel Co.

(*Continued on page* 255)

By the use of high electrical voltage Metalmaster has given its user the power and speed to cut the hardest metals man has been able to produce . . . This we call DISINTEGRATION for it actually disintegrates the metal without affecting the hardness.

Metalmaster Disintegrators save thousands of dollars each month for their users through the salvage of workpieces normally going into scrap.

One firm alone through the use of two Metalmasters saves annually over $70,000.00 in just tool and die repair alone.

IMAGINE, for a moment, the potential . . . if you could cut ANY shape hole, ANY size in ANY hardened metal!

IMAGINE, for a moment, the potential . . . if you could cut a CURVED HOLE IN METAL!

IMAGINE, for a moment, the potential . . . if you could save that enormous scrap pile of workpieces with broken taps, drills, reamers, etc. You can do it with Metalmaster . . . in a matter of minutes per part.

IMAGINE, for a moment, the potential . . . of a machine that in many cases saves its initial cost in just one free demonstration in a customer's plant. This is a common occurrence with Metalmaster.

For information relative to the many machines available for your type operation and the many advantages Metalmaster can offer your firm, write today on your company letterhead to:

METALMASTER DIVISION:
CLINTON MACHINE COMPANY
CLINTON, MICHIGAN

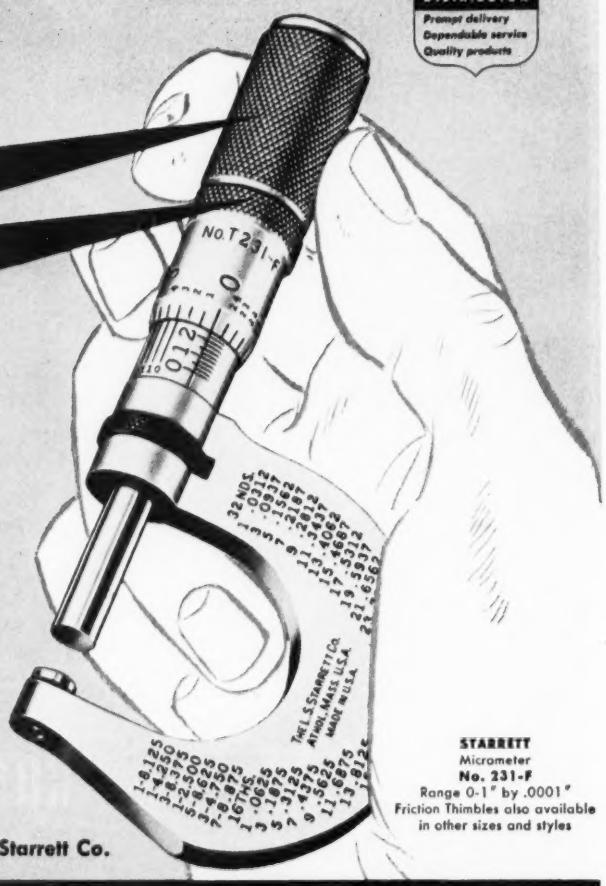
Remove Broken Taps fast without distortion
Cut oil holes in hardened gears without annealing
Cut dovetails in hardened dies
Cut any shape hole in cemented carbides

Starrett

*Satin Chrome** MICROMETERS

with FRICTION THIMBLE * *plus* DIRECT FEEL

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
Quality products



STARRETT
Micrometer
No. 231-F
Range 0-1" by .0001"
Friction Thimbles also available in other sizes and styles

Starrett *Friction Thimble Micrometers* give you both *friction control* and *direct feel* in a micrometer designed for easy, one-hand use. An improved friction control mechanism built into the upper portion of the thimble is "right under your thumb" for fast, accurate repetitive measurements. Lower section of the thimble is integral with the spindle with location and large diameter just right for quick control and "direct feel" on critical measurements.

Only Starrett Micrometers offer you this modern convenience plus 12 other big features. Get them all by insisting on *STARRETT* Micrometers. Your industrial distributor will give you prompt, dependable, quality service.

*Pioneered and Developed by The L. S. Starrett Co.

ONLY Starrett HAS THESE 12 BIG FEATURES

1. ONE-PIECE SPINDLE — Extra rigid integral construction for long, accurate life.

2. REPLACEABLE, ADJUSTABLE SLEEVE — Can be replaced if damaged or worn.

3. EXTRA HARD THREADS — Special high carbon steel gives harder threads which are hardened, stabilized and ground from the solid.

4. HI-MICRO MIRROR LAPPED FINISH — On faces of anvil and spindle. Also available with carbide faces at slight additional cost.

5. NO-GLARE SATIN CHROME FINISH — On thimble and sleeve of all micrometers, also on frame of all full finish micrometers. No glare, no squint, no eye strain. Resists stains, corrosion and wear.

6. TAPERED FRAME — Permits measurements in narrow slots and tight places. Standard on all full finish outside micrometers.

7. RIGID, ONE-PIECE FRAME — Barrel is integral with frame for maximum rigidity, accuracy and long life.

8. EASY TO READ — Large diameter thimble and sleeve with distinct black figures and graduations against satin chrome finish. Easy to read under any illumination.

9. QUICK READING FIGURES — Every graduation numbered for quick, positive identification.

10. CONVENIENT DECIMAL EQUIVALENTS — of 8ths, 16ths, 32nds and 64ths on frame or thimble of all micrometers.

11. QUICK, EASY ADJUSTMENT — Only two simple adjustments maintain Starrett accuracy.

12. LOCK NUT — Permits locking of spindle a any reading. Available at slight additional cost.

FREE STARRETT CATALOG FEATURING NEW TOOLS

THE L. S. STARRETT CO.
Dept. D, Athol, Mass., U. S. A.

Please send Catalog 26A containing *New Tools* section plus 300 page display of the complete line of Starrett precision tools, dial indicators, steel tapes, hacksaws, band saws, band knives and precision ground die and flat stock.

Name.....Position.....
Company.....
Address.....
City.....Zone....State.....

Starrett®

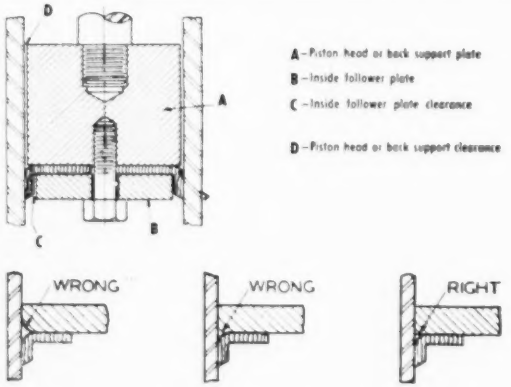
"WORLD'S GREATEST TOOLMAKERS"

STARRETT TOOLS

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS · DIAL INDICATORS · STEEL TAPES
PRECISION GROUND FLAT STOCK · HACKSAWS, BAND SAWS and BAND KNIVES
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

For more information on products advertised, use Inquiry Card, page 243

RECOMMENDED CLEARANCES FOR LEATHER CUP PACKINGS



Inside Follower-Plate Clearance, where T = Thickness of the Leather

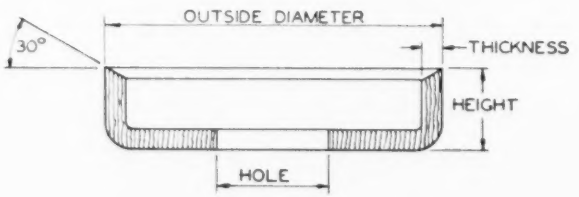
Medium	Clearances on Each Side
Water	0.33T
Oil	0.25T
Air	0.25T

Piston-Head or Back-Support Clearances for Pressures up to 20,000 Pounds per Square Inch

Plunger Diameter, Inches	Clearance on Diameter, Inch	Plunger Diameter, Inches	Clearance on Diameter, Inch	Plunger Diameter, Inches	Clearance on Diameter, Inch
1	0.003	9	0.004	24	0.006
2	0.003	10	0.004	28	0.006
3	0.003	12	0.005	32	0.006
4	0.003	14	0.005	36	0.007
5	0.003	16	0.005	40	0.007
6 7 8	0.004	18	0.006	44	0.007
	0.004	20	0.006	48 and over	0.007
	0.004	22	0.006		

MACHINERY'S Data Sheet No. 748, February, 1954 Compiled by the American Leather Belting Association

RECOMMENDED DIMENSIONS FOR LEATHER CUP PACKINGS



Outside Diameter, Inches	Height of Packing, Inches	Hole Diameter, Inches	Thickness of Leather, Inch	
			Minimum	Maximum
1 2	1 4		1 32	1 16
3 4	5 16	To suit	1 32	1 16
1	1 2	operating	1 32	3 32
2	1 2	conditions;	1 16	1 8
3	5 8	consult	3 32	5 32
4	5 8	mechanical	3 32	5 32
5	3 4	leather	3 32	5 32
6	3 4	packings	1 8	3 16
7	3 4	supplier	1 8	3 16
8	1		1 8	3 16
9	1		1 8	3 16
10	1		1 8	3 16
12	1 1 4		1 8	3 16
14	1 1 4		1 8	3 16
16	1 1 2		1 8	3 16
18	1 1 2		1 8	3 16
20	1 3 4		1 8	3 16
22	1 3 4		1 8	3 16
over 24	2		1 8	3 16

MACHINERY'S Data Sheet No. 747, February, 1954 Compiled by the American Leather Belting Association

The operator brings the rotating lapping stone into contact with work centers to correct inaccuracies.

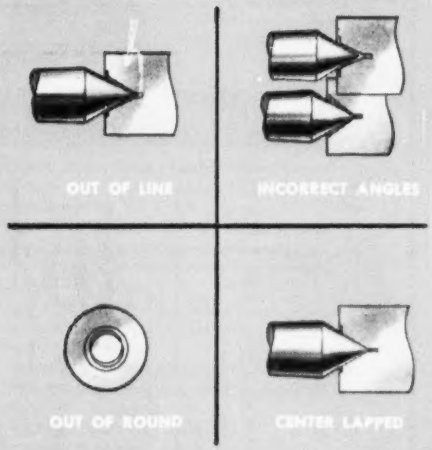
EX-CELL-O

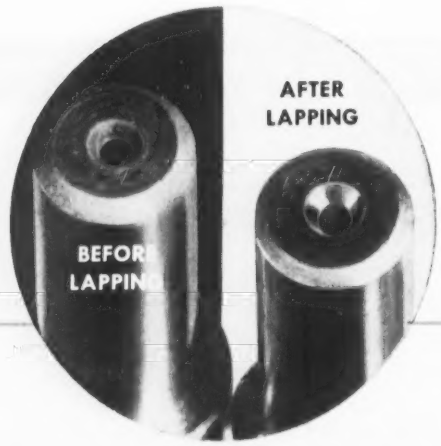
CENTER LAPPING MACHINES

FOR GREATER PRECISION IN SUBSEQUENT MACHINING

Meeting today's precision standards requires careful checking of every phase of the job, *including the center holes in the work*. Ex-Cell-O Center Lapping Machines correct inaccuracies of center holes, thus contributing to greater precision in all subsequent operations performed between centers. These machines are precision built and are easy to operate. The lapping stone is dressed to a 60° angle by a hand operated diamond dresser. An adjustable dresser for other angles also is available. These machines are fully described in Bulletin 40271—a copy is yours for the asking.

Eliminate out-of-line, out-of-round, and incorrect angles by Center Lapping





EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
DAIRY EQUIPMENT • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS

53-44

the newly established cobalt section of the nickel sales department.

WILLIAM A. CARLSON has been named factory representative by the Hy-Pro Tool Co., New Bedford, Mass., Mr. Carlson, covering western New York and northern Pennsylvania will make his headquarters in Rochester, N. Y.

FRED W. GOTTSCHLING has been named director of engineering of Greer Hydraulics, Inc., Brooklyn, N. Y.

E. W. KEIR Co., 2201 W. Clybourn St., Milwaukee, Wis., has been named Wisconsin sales representative for the ADAMAS CARBIDE CORPORATION, Harrison, N. J. Adamas, manufacturer of carbide tools, dies, and wear parts, has also appointed the C. W. DAVIDSON Co., 406 N. Illinois St., Indianapolis, Ind., sales representative for Indiana; and the D. A. OLSON Co., 7306 55th Ave., N. E., Seattle, Wash., sales representative for Washington and Oregon.

HOWARD C. FOSTER has been transferred to the Clifton, N. J., branch office of the Gisholt Machine Co., Madison, Wis. Mr. Foster, who has been with the company for fourteen years, will be doing both sales and service work in the area.

Ohio

C. V. GREGORY has been appointed to the newly created position of manager of district sales for the Reliance Electric & Engineering Co., Cleveland, Ohio. He will be responsible for the administration of district sales activities from the national sales headquarters in Cleveland. Mr. Gregory was manager of the Pittsburgh, Pa., district, this position now being filled by ELWOOD H. KOONTZ, former branch manager at Newark, N. J. F. RAYMOND OBENCHAIN, sales engineer at the Newark office for the last three years, is taking over Mr. Koontz's duties. WILMER K. SCHLOTTERBECK has been named Buffalo, N. Y., district manager, succeeding C. B. ALLEN, JR., who is being transferred to the Detroit, Mich., managership. ANTONY C. SCHETTLER has been named Reliance branch manager at Baltimore, Md.

WALTER F. ROCKWELL, president of the Timken-Detroit Axle Co. for thirty-three years—until that company's merger last September with the Standard Steel Spring Co. to form the Rockwell Spring & Axle Co.—was elected chairman of the board of the Acro Mfg. Co., Columbus, Ohio. F. G. MCCLOSKEY, formerly executive vice-president and a director of Acro, has been named president. He succeeds F. P. MAXWELL who resigned to assume the vice-presidency of the Power Tool Division of the Rockwell Mfg. Co. Acro manufactures switches and temperature controls for domestic heating equipment and fractional-horsepower specialty gear-motors.

LODGE & SHIPLEY Co., Cincinnati, Ohio, manufacturer of metal-working lathes and specialized metal turning equipment, has acquired through merger the COLUMBIA MACHINERY & ENGINEERING CORPORATION, Hamilton, Ohio, which will be known as the Columbia Division of Lodge & Shipley Co. The Columbia concern, established in 1942, manufactures power squaring shears, power press brakes, and metal forming presses for the metal-working industry and hydraulic presses for the woodworking, plastic, and fiber industries. According to the announcement, there will be no change in management or personnel.

DINGLE-CLARK Co., Cleveland, Ohio, electrical contractor and sales agent for the Cleveland Worm & Gear Co. and the Farval Corporation, both of Cleveland, Ohio, announces these promotions: JAMES P. MURRAY, JR., salesman, to vice-president in charge of the Pittsburgh, Pa., district, succeeding the late Harry M. Leathers; ROBERT G. SMITH, purchasing agent, to the construction sales department; and G. S. WILKINSON, assistant purchasing agent, to succeed Mr. Smith as purchasing agent.

RELIANCE ELECTRIC & ENGINEERING Co., Cleveland, Ohio, announces the addition of six application engineers to the sales force: A. W. BRIDGES and L. W. KUTZ, Philadelphia, Pa., office; C. A. EMMERT, Baltimore, Md., office; JAMES W. LANDERS, Newark, N. J., branch; WILLIAM M. MORRIS, JR., New Haven, Conn., office; and WILLIAM J. CONSTANDSE, Cincinnati, Ohio, district office.

JOSEPH A. CADEMARTORI has been promoted from superintendent to general manager of the Elmes & King Division of American Steel Foundries, Cincinnati, Ohio. WALTHER ROTHACKER succeeds Mr. Cademartori as superintendent. GEORGE C. MARAKAS has been placed in charge of sales for the Division.

CLYDE E. ROBERTS has been appointed manager of sales for the alloy steel division of the Republic Steel Corporation, Cleveland, Ohio. He succeeds MARTIN H. SCHMID, who is retiring. SAM A. SECKLER has been made assistant sales manager of the division, the post previously held by Mr. Roberts.

CHARLES R. BENDER has been appointed assistant secretary of the National Tool & Die Manufacturers Association, with headquarters in Cleveland, Ohio. In his new capacity Mr. Bender will be concerned chiefly with membership work.

HOWARD H. NUERNBERG is the sales representative for the new Dayton, Ohio, office of the Falk Corporation, Milwaukee, Wis. The office, a branch of the Cincinnati district, is located at 410 W. First St.

CONNELL MACHINERY Co., Toledo, Ohio, has been made sales representative in northwest Ohio for the R. K. LEBLOND MACHINE TOOL Co., Cincinnati, Ohio, manufacturer of Lathes and lathe attachments.

LOUIS WOZAR has been appointed president and general manager of the Dayton Pump & Mfg. Co., Dayton, Ohio. Mr. Wozar joined the firm in 1948 as assistant to the president.

R. O. WILLOUGHBY and L. G. JONES have joined the Canton Division of the E. W. Bliss Co., Canton, Ohio, as superintendent of ordnance and manufacturing manager, respectively.

RESEARCH INSTRUMENT Co., 12410 Triskett Road, Cleveland, Ohio, has been appointed Ohio sales representative by the TINIUS OLSEN TESTING MACHINE Co., Willow Grove, Pa.

WILLIAM E. BRYDEN has joined the Coolidge Corporation, Middletown, Ohio, manufacturer of precision ground balls, in the capacity of sales manager.

LESLIE B. BELLAMY has been appointed general manager of the Sterling Abrasives Division, Cleveland Quarries Co., Tiffin, Ohio.

Pennsylvania and Washington, D. C.

DR. RUSH A. LINCOLN has been appointed chief metallurgist of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Dr. Lincoln, formerly manager of the sales development and engineering service, succeeds CHARLES A. SCHARSCHU, who has retired. LOUIS B. POLEN succeeds R. J. BRYAN as plant manager of the company's Buffalo, N. Y., foundry, Mr. Bryan having retired. Mr. Polen joined Allegheny Ludlum in 1948 as plant metallurgist. WILLIAM J. BALDWIN, formerly assistant plant manager at Watervliet, N. Y., has been appointed West Coast technical representative, with headquarters at the company's Los Angeles, Calif., office. His successor as assistant plant manager is RICHARD P. STEMMLER, formerly manager of the Los Angeles forge plant. DONALD J. ROBERTSON, who was superintendent, replaces Mr. Stemmler.

LATHAM E. OSBORNE, formerly executive vice-president for defense products of the Westinghouse Electric Corporation, Pittsburgh, Pa., was appointed executive vice-president. Mr. Osborne, with Westing-

house since 1910, has also been elected to the board of directors. LESLIE E. LYNDE, vice-president in charge of the Aviation Gas Turbine Division at South Philadelphia, Pa., will become vice-president of defense products in Mr. Osborne's stead. In addition to the Aviation Gas Turbine Division, he will be responsible for the Atomic Power, Air-Arm, Electronics, and X-Ray Divisions, and for the coordination of defense activities throughout the company.

DE WALT INC., Lancaster, Pa., subsidiary of AMERICAN MACHINE & FOUNDRY CO., announces these changes in personnel: W. ROSS STEVENS, advertising manager, has retired after completing more than twenty-seven years' service with the company, but will remain as a special consultant; JOHN STOLARZ, formerly industrial sales manager, will direct the advertising and sales promotion departments; LESTER R. MELLOTT will be assistant sales promotion manager; and ARTHUR J. McMURRAY, formerly sales manager for home work-shop equipment, will be assistant general sales manager.

THOMAS T. CROWLEY has been appointed staff assistant to the executive vice-president of the Crucible Steel Company of America, Pittsburgh, Pa. Prior to joining the company, Mr. Crowley was assistant to the president of the Inland Steel Container Co. In 1948, he was a member of the E. C. A.'s Special Mission to the United Kingdom as steel advisor, and later became Chief of the Industry Division.

RICHARD E. MILLER, general manager of the Columbus, Ohio, plant, of the Rockwell Mfg. Co., Pittsburgh, Pa., has been appointed to the newly created position of product sales manager for saws and expendable tools sold by the Delta Power Tool Division. Mr. Miller, who joined Rockwell in 1947, will make his headquarters in Pittsburgh.

E. H. MANN has become general sales manager of the Alloy Metal Wire Co., a division of the H. K. Porter Co., Inc., Prospect Park, Pa. Mr. Mann came to Alloy Metal Wire in 1949 as a sales engineer for the Middle Atlantic district, and in 1953 was promoted to district manager to establish the New England office at Worcester, Mass.

ALLAN CHILTON has been appointed chief engineer for the Aviation Gas Turbine Division of the Westinghouse Electric Corporation, South Philadelphia, Pa. W. M. TRIGG has been named manager of the new metals development plant to be built at Blairsville, Pa., while LEONARD W. GOLDEN and R. D. ROWLEY have been made top assistants. Mr. Golden will be responsible for metals casting and manufacture of powdered metal parts; Mr. Rowley for wrought alloy manufacture.

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa., manufacturer of hammers and other forging equipment, is erecting a new administration building to meet the need created by increased scientific services, engineering studies, and equipment demonstrations.

ROLLWAY BEARING CO., INC., Syracuse, N. Y., announces the removal of its Philadelphia, Pa., office to 3701 N. Broad St. WILLIAM B. ALLISON, engineering representative, is in charge.

ROBERT W. O'NEAL has become associated with the Rees Machinery Co., Inc., Pittsburgh, Pa., as a sales engineer. He was formerly chief industrial engineer for the Follansbee Steel Corporation.

JOHN E. HARTMAN has joined Firth Sterling, Inc., Pittsburgh, Pa., in the position of assistant to the sales promotion manager.

TRANSMISSION ENGINEERING CO., INC., 244 N. 22nd St., Philadelphia, Pa., distributor for the CONE-DRIVE GEARS DIVISION OF THE MICHIGAN TOOL CO. in the Philadelphia area, will also represent Cone-Drive as sales engineers to manufacturers in Delaware, southeastern Pennsylvania, southern New Jersey, and eastern Maryland.

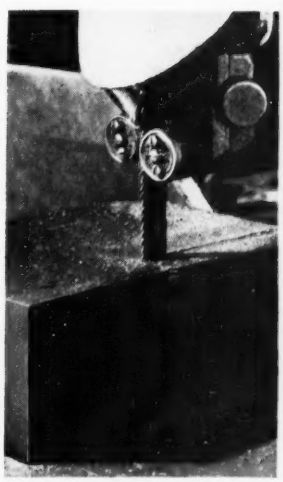
KENNETH A. AYERS has been named district manager of the Washington, D. C., office of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa.

Vermont, Massachusetts, and Connecticut

JONES & LAMSON MACHINE CO., Springfield, Vt., has announced a reorganization of its operations with the formation of three decentralized operating divisions and the creation of a Marketing Division. The operating divisions are as follows: Machine Tool Division, with JAMES C. HEBERT as manager; Comparator Division, with ROBERT O. BEARDSLEY as manager; and Thread Tool Division, with JOHN E. BARBIER as manager. The two last-named divisions will be located in the new building on Clinton St. The newly created Marketing Division, with HOWARD A. FINCH as manager, will handle all district office organizations, agents, distributors (both foreign and domestic), public relations and advertising, and market research and sales analysis, as well as all sales policies. Also announced by the company was the creation of the position of manager of manufacturing, ROBERT S. JONES being appointed to this post. He will be responsible for all manufacturing and labor policies of Jones & Lamson. DAVID N. SMITH has been named manager of engineering research.

(Left to Right) James C. Hebert, manager of the Machine Tool Division of the Jones & Lamson Machine Co.; Robert O. Beardsley, manager of the Comparator Division; John E. Barbier, manager of the Thread Tool Division; and Howard A. Finch, manager of the Marketing Division

Pick the Top "NAME BAND" for all these Metal-Sawing Jobs

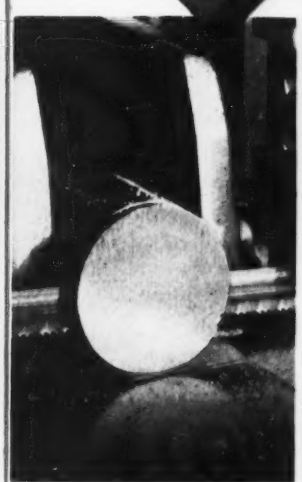


For Heavy Production Cutting

You'll like this rugged, break-resistant standard tooth blade for trimming gates and risers off castings, cutting metal bars and other tough production work. Hardened along the tooth edge only, it cuts fast, stays sharp, gives a longer run for your money! All standard widths and tooth spacings. Furnished in 100′ and 300′ coils or welded to length for specific machines.

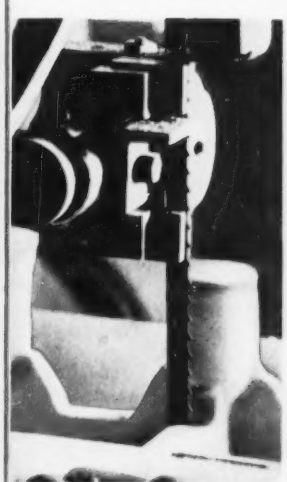
For Contour Cutting and Die Making

In the narrower widths, this edge-holding, smooth cutting blade is an outstanding favorite for contour work. Because the teeth are set with absolute evenness on both sides of the blade, you can depend on straight, on-the-line cuts with no "leading." All standard widths and tooth spacings furnished in 100′ and 300′ coils or welded to specified length.



For Horizontal Cut-Off Work

Furnished either Regular or Wavy Set in the wider widths, this Simonds-made standard tooth blade easily handles the wide variety of cutting required in general shop and steel warehouse operation. All sizes come in 100′ and 300′ coils or welded to length.



For Cutting Soft Materials

This Skip-Tooth Hard Edge Blade has extra gullet capacity with maximum blade strength . . . gives fast, trouble-free service in cutting aluminum, magnesium, plastics, plywood and hardwood. All standard sizes available in 100′ and 300′ coils or welded to length for specific machines.

Get Delivery From Stock From Your Industrial Supply Distributor

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon.
Canadian Factory in Montreal, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

(Left) Douglas R. Starrett, newly appointed vice-president in charge of plant operations at the L. S. Starrett Co.; and (right) Carl O. Newton, sales manager

L. S. STARRETT CO., Athol, Mass., announces the following personnel changes: DOUGLAS R. STARRETT, previously assistant vice-president, takes over new duties as vice-president in charge of plant operations; CARL O. NEWTON, formerly eastern sales manager, becomes sales manager; and DONALD E. GILBERT assumes new duties as eastern sales manager. Mr. Gilbert was formerly New York branch manager. ROY M. PECKHAM, previously Atlanta, Ga., representative, becomes southern sales manager; CARL G. NORDMARK, advertising manager of the company, is now advertising and sales promotion manager; and FREDERICK H. CLARKSON of the advertising department has been promoted to assistant advertising manager.

JACK M. ESTEN has been appointed an abrasive engineer, and ROBERT C. DIVOLL a field engineer, for the Norton Co., Worcester, Mass. Mr. Esten's territory includes North and South Carolina, Virginia, and part of Tennessee. Mr. Divoll is working out of the Pittsburgh, Pa., district office.

ROBERT E. BYRNE has been appointed chief engineer, and CHARLES T. MOONEY, production superintendent, of the the Worcester Pressed Steel Co., Worcester, Mass.

W. H. C. BERG has been named director of standards and research for the Hanson-Whitney Division of the Whitney Chain Co., Hartford, Conn. Mr. Berg has been engaged in research and development work in the field of metallurgy for more than thirty years.

EDGAR G. SEYBOLD has been elected president of the Hendey Machine Co., Inc., Torrington, Conn. Mr. Seybold joined the company in 1937, and for the past year served as executive vice-president. He is succeeding DAVID AYR, who has retired after twenty-one years as president. HELGE G. HOGLUND and BERNARD SASSEN continue as vice-president in charge

Edgar G. Seybold, president of Hendey Machine Co., Inc.

of sales and vice-president in charge of engineering, respectively. Also elected were ARTHUR D. PATTERSON, secretary and treasurer, and EARL BETZ, assistant treasurer.

* * *

Tiny motors that are used today to operate the control surfaces of a modern jet fighter generate approximately twice as much horsepower as was provided fifty years ago to propel the Wright Brothers' historic first airplane.

Coming Events

APRIL 26-28—1954 Metal Powder Show and Tenth Annual Meeting sponsored by the METAL POWDER ASSOCIATION, to be held at the Drake Hotel, Chicago, Ill. For further information, write to the Association, 420 Lexington Ave., New York 17, N. Y.

APRIL 26-30—Tenth Biennial Industrial Exposition of the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at Convention Center in Philadelphia, Pa. Executive secretary, Harry E. Conrad, 10700 Puritan Ave., Detroit 21, Mich.

MAY 4-7—National spring technical meeting of the AMERICAN WELDING SOCIETY to be held at the Hotel Statler, Buffalo, N. Y. in conjunction with the Second Welding and Allied Industry Exposition at the Buffalo Memorial Auditorium. National secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

MAY 17-20—SECOND BASIC MATERIALS EXPOSITION AND CONFERENCE to be held at the International Amphitheatre, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

JUNE 6-9—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION to be held at the Homestead, Hot Springs, Va. Executive secretary, John C. Sears, Empire Bldg., Pittsburgh 22, Pa.

JUNE 7-10—Sixth National Plastics Exposition sponsored by the SOCIETY OF THE PLASTICS INDUSTRY, INC., at the Public Auditorium in Cleveland, Ohio. Chairman, P. H. Grunnagle, Society of the Plastics Industry, Inc., 67 W. 44th St., New York 18, N. Y.

* * *

Film Deals with Safety in Welding

A new sound slide-film dealing with safety in the use of oxy-acetylene cutting and welding equipment has been produced by the Air Reduction Sales Co. The film, which is entitled "The Guy Behind Your Back," is a fundamental approach to the factors affecting safety when operating oxy-acetylene welding torches, cutting torches, and cutting machines. It is designed to aid companies in training their employes.

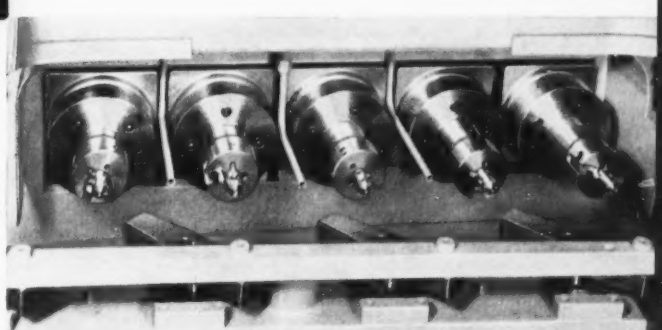
The story is unfolded by the use of many cartoons accompanied by fluent narrative designed to make the serious business of safety in welding easy to absorb. Information regarding free showings of this twenty-minute film may be obtained from the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.

80 SURFACES IN 1 CYCLE

EX-CELL-O

MACHINE BORES, COUNTERBORES, FACES AND CHAMFERS 20 HOLES

This Ex-Cell-O Precision Boring Machine performs operations on 80 surfaces in one cycle on the projecting holes of a cotton picker bar assembly. Five spindles on the machine bridge are positioned to engage every fourth hole. The fixture indexes automatically between machining strokes to align the next set of holes with the boring bars.



The machine is a standard Style 112-C having a heavy well-ribbed base and table, long stroke; handles medium-sized and large work.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

XLO
EX-CELL-O for PRECISION

Ex-Cell-O's line of standard Precision Boring Machines is exceptionally complete. Ask your local Ex-Cell-O representative about them, or write to Ex-Cell-O in Detroit for Catalog 31205.

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

53-37

New Books and Publications

WELDING ENGINEERING. By Boniface E. Rossi. 786 pages, 6 1/4 by 9 1/4 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, $8.

This volume is an up-to-date account of the technical phases of welding, based on recognized practices in the industry. It is intended to familiarize the student or beginner with fundamental facts; to give those now in the welding field a wider understanding of the process; and to provide a reference source for the draftsman, designer, engineer, and anyone else seeking information on welding and its application. The welding terms used conform to those recently standardized by the American Welding Society.

The material is handled in four sections: (1) A Survey of the Different Welding Processes and Their Basic Principles, with individual chapters on gas welding; the electric arc and its application to welding; equipment and materials for bare and shielded metal-arc welding; bare and shielded metal-arc welding; submerged arc welding; inert-gas-shielded arc welding; atomic-hydrogen welding; resistance welding; soft soldering, brazing, and braze welding; oxygen and arc cutting of metals; and safe practices and health precautions in welding and cutting. (2) Metals and Their Weldability. (3) Design and Fabrication Considerations. (4) Testing and Inspection.

FORMULAS FOR STRESS AND STRAIN. By Raymond J. Roark. 381 pages, 6¼ by 9¼ inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $7.50.

To bring together solutions and data required by engineers who are concerned with machines and structural design is the intention of this reference book, now in the third edition. According to the author, there is a need for more accurate methods of stress analysis imposed by the trend of engineering practice toward greater speed and complexity of machinery, greater size and diversity of structures, and greater economy and refinement of design.

The book is divided into three parts. The first contains definitions and symbols. The second part—on facts, principles, and methods—contains the following chapters: Behavior of Bodies under Stress; Principles and Analytical Methods; Experimental Methods; and Properties of a Plane Area. Formulas and examples are presented in the third part under the following chapter headings: Tension, Compression, Shear, and Combined Stress; Beams, Flexure of Straight and Curved Bars; Torsion; Flat Plates; Columns and Other Compression Members; Pressure Vessels; Pipes, Bodies under Direct Bearing and Shear Stress; Elastic Stability; Dynamic and Temperature Stresses.

APPLIED DESCRIPTIVE GEOMETRY WITH DRAFTING-ROOM PROBLEMS. By Frank M. Warner. 247 pages, 6¼ by 9¼ inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $4.

A twofold purpose is carried out in this text-book—first, to teach a few fundamental principles of geometry and show their application to engineering problems; and second, to present a large variety of problems with engineering data and terms so as to give the student practice in applying these principles. Accordingly, about ninety pages of the book are devoted to problems. This is the fourth edition of the book, and about twenty-five new problems have been added.

Following are the chapter headings: Orthographic Drawing; Fundamental Auxiliary Views; Point, Line, and Plane Problems; Revolution; Concurrent Noncoplanar Forces; Curved Lines and Surfaces; Intersection of Surfaces; Practice Problems; Drafting-Room Problems.

THE SCIENCE OF PRECISION MEASUREMENT. 264 pages, 6 by 9 inches. Published by the DoAll Co., Des Plaines, Ill. Price, $3.50.

This book is an expanded edition of a manual published in 1952 on the subject of dimensional quality control. It begins with a discussion of the history, development, and purpose of precision measurement, then examines the end purpose of precision measurement—the maintenance of clearances and tolerances. Practical procedures to be followed in utilizing gage-blocks and the various gaging instruments, such as sine-bars, optical flats, electrical comparators, straightedges, squares, and height gages, are expounded. To make the fundamentals more easily understood, simple charts, diagrams, and photographs illustrate the subject matter. Mathematical tables and a glossary complete the book.

MILLING CUTTERS. 39 pages, 8 1/2 by 11 inches. Published by the Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price, $1 (paperbound).

This pamphlet has been compiled by the Research and Technical Committee of the Milling Cutter Division of the Metal Cutting Tool Institute, and constitutes a report intended to serve as a guide to industry in properly applying the many available tool materials with respect to correct design, use, and care of milling cutters. There are four sections: The Over-All Economics of Milling Operations; Milling Cutter Design; Application of Milling Cutters; and Sharpening and Care of Milling Cutters. Two pages of nomenclature are included to promote uniform terminology.

GRAPHICAL SPRING DESIGN. (No. 32 in the Yellow Back Series.) 64 pages, 5 1/2 by 8 1/2 inches. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, 75 cents.

This treatise considers the many variables that are factors in spring design. Useful charts and text material simplify the application of standard formulas. Round and flat helical springs, and volute, spiral, cantilever, and disc springs are covered. A chapter devoted to the characteristics of beryllium copper, now used for springs, is included.

EPICYCLIC GEARING. By W. Brown (No. 33 in the Yellow Back Series). 46 pages, 5 1/2 by 8 1/2 inches. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, 75 cents.

This text presents valuable information concerning the kinematics and torque distribution of epicyclic gears in general. The analysis of existing trains is fully dealt with to familiarize the reader with the basic principles of epicyclic gears. The synthesis of trains to meet specific requirements is discussed, and examples are given.

SHELL MOULDING. (No 34 in the Yellow Back Series.) 94 pages, 5 1/8 by 8 1/2 inches. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, 75 cents.

Current practices used in the new foundry technique of shell molding are reviewed in this book. The principles and advantages of the process are stated, as well as the selection and use of mold materials, core-making, shell-molding machines, pouring, and the production of iron, stainless-steel, bronze, and light-alloy castings.

matchless performance

when the chips are down!

High Speed Steels

BY Vanadium-Alloys

VASCO SUPREME — Highest hardness, highest wear resistance, supreme in the field. (U.S. Pat. 2174286).

NEATRO — Resistance to abrasion exceeds all steels except Vasco Supreme. Excels for both heavy and light cutting.

VAN CUT — High carbon, high vanadium. Properties intermediate between Vasco M-2 and Neatro for easier grinding. Suitable for all types of cutting tools.

RED CUT SUPERIOR — The nation's best known general-purpose steel. Readily fabricated and heat treated. Shines in a host of applications.

Write

for your free copy of our comprehensive HIGH SPEED STEELS Catalog — grades, applications, heat treatment — helpful, complete!

VASCO M-2 — The original 6-6-2 type steel. Wide hardening range, good machining characteristics, outstanding economy in service.

8-N-2 — Low tungsten, high molybdenum, very tough at high hardness. Excels for fine edged tools.

VAN-LOM — High molybdenum, high vanadium. Best cutting performance of all high molybdenum steels.

Vanadium-Alloys
STEEL COMPANY
LATROBE, PA.
COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL COMPANY

HANDY-QUIK TOLERANCES. By Alexander Michael, Sr. 98 pages, 3¾ by 5½ inches. Published by the Handy Length Book Co., 3507 17th Street, S. W., Canton, Ohio. Price, $1 (paper bound).

In this booklet, fractional dimensions and their decimal equivalents are combined with ten thousandths to make tables that show sizes and plus and minus tolerances.

AMERICAN STANDARD KNURLING (ASA B5.30-1953). 15 pages 8 ½ by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price $1.

Obituaries

CHARLES OWEN BURGESS, metallurgist and technical director of the Gray Iron Founders' Society, Cleveland, Ohio, died at his home in Cleveland on January 13. Mr. Burgess was graduated from Lehigh University in 1923 with the degree of Metallurgical Engineer. Prior to joining the Society's staff in 1948, he was head of the industrial service department of the research division of the Union Carbide and Carbon Corporation. He held more than a dozen patents in the steel and gray iron field, and was author of technical articles on the metallurgy of iron and steel. At the time of his death, Mr. Burgess was nearing completion of a gray iron handbook for users of castings.

RANSOM SOPER, Long Island sales representative for the Rudel Machinery Co., Inc., New York City, died on December 30 in Garden City, New York, at the age of fifty-seven years. Mr. Soper, who had been associated with the machine tool industry since 1915, joined the Rudel Machinery Co., Inc., in 1948.

* * *

Ten Educational Awards Announced by A.S.T.E.

Ten International Education awards for 1954, nine to be made in the United States and one in Canada, have been announced by the American Society of Tool Engineers for full-time engineering students interested in pursuing tool and production engineering as a profession. Grants will be made effective with the school year beginning this autumn and will total $700 yearly per student. Awards will be made only to students who are already at least in their third year of a four- or five-year curriculum.

Finishes for Aluminum

A most important type of finish for aluminum, according to an article in the Reynols Metals *Technical Advisor*, is the electrolytic oxide coating. The various oxide finishes are obtained by treating the metal anodically in various electrolytes in such a manner as to obtain a thin, inert, and durable aluminum oxide on the metal surface. The film formed is very hard and offers excellent abrasion and corrosion protection to the underlying metal. Some of these films are clear and transparent. Others are colored in varying degrees of brown, gray, and silver. They are very high in dielectric strength and possess good absorption qualities for dyes and paints, since most are minutely porous. Color and hardness of the film will vary somewhat with the type of aluminum alloy anodized.

The method of anodic film formation is not complicated. In anodizing, the aluminum is made the anode, instead of the cathode as in electroplating. An electrolyte capable of yielding oxygen on electrolysis is used.

When current is passed, an initial oxide film forms on the aluminum surface, and progressive oxidation takes place beneath the film thus formed. Hence, the film formed last is next to the metal and the oldest part of the film is on the surface. This outer part of the film is less dense and is softer than at the metal interface, since it has been subjected to the most severe solvent action. The aluminum-oxide film produced is minutely porous. Thus current is able to pass through the electrolyte in the pores to the metal without too much resistance.

After formation, it is possible to convert aluminum oxide in the coating into the monohydrate by treatment with boiling water. This is known as sealing and the result of treatment of the anodic coating with boiling water is to close the pores effectively, thus destroying the absorptive characteristics of the coating. Although aluminum may be anodized in other acids, the chromic and sulphuric acid processes are of the greatest commercial importance.

Chromic Acid Process

The chromic acid method of anodizing should be preceded by cleaning the aluminum in a hot, mild alkaline solution, followed by a rinse in clear, cold water. The work is then made the anode in a 5 to 10 per cent solution of chromic acid, maintained at a temperature of approximately 95 degrees F.

A low-voltage direct current is applied initially and then is increased as rapidly as possible to 40 volts. The current density varies from 1 to 5 amperes per square foot.

It usually requires about five minutes to reach 40 volts, after which the work is treated at this potential for thirty minutes. The parts are then removed from the tank and rinsed in water to remove the excess acid solution.

This produces a gray or greenish-gray aluminum-oxide film which is inert, corrosion-resistant, and absorptive. This film may be subsequently colored by dipping in dye baths. The average thickness of chromic acid oxide films is about 0.00005 inch, but the thickness depends mostly on the current density and time of treatment.

The chromic acid process is particularly adapted to the anodizing of assembled parts, since the corrosion resistance of the aluminum surfaces is not appreciably affected by any acids that may be trapped in the joints. The film also serves as an excellent paint base.

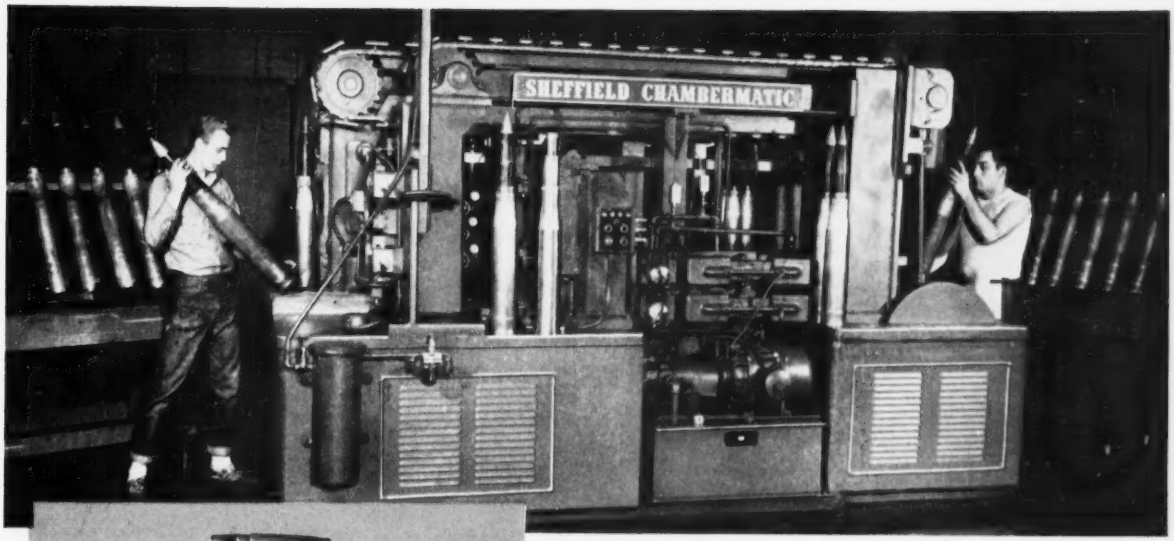
Sulphuric Acid Process

The use of a sulphuric acid electrolyte for anodizing aluminum and its alloys is part of the Alumilite process. This process usually employs direct current, but alternating current may be used if desired. A number of patents relating to anodizing with sulphuric acid and other processes included in the Alumilite treatment are held by the Aluminum Company of America.

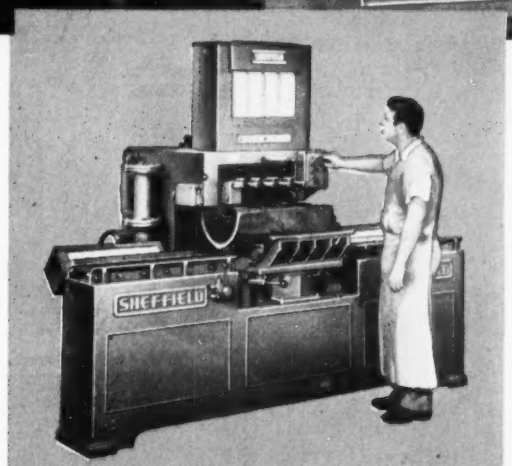
The work is first cleaned, generally in a hot, mild alkaline solution. Then it is rinsed thoroughly in cold water. After this the parts are made the anode in a 10 to 25 per cent solution of sulphuric acid maintained at about 70 degrees F. The time of treatment varies, but it is usually twenty to thirty minutes at 15 to 20 volts direct current. After anodizing, parts are rinsed; the oxide film formed may be dyed if desired.

The acid concentration of the anodizing bath may be varied from 5 to 70 per cent, depending on the composition of the alloy being treated and the nature of the oxide film desired. In general, the oxide films obtained in a sulphuric acid electrolyte are very corrosion- and abrasion-resistant, possess good absorption qualities, are inert, and heat-resistant. Oxide films are commercially made in a sulphuric acid electrolyte to have a thickness ranging from 0.0001 to 0.001 inch.

The use of the sulphuric acid process or the use of any oxidizing acid, except chromic, is not recommended in cases where there is high probability of acid being retained by capillary action in a closed space such as a lapped joint, since any acid so retained will cause subsequent deterioration of the aluminum. The sulphuric acid process is the most economical anodizing process.



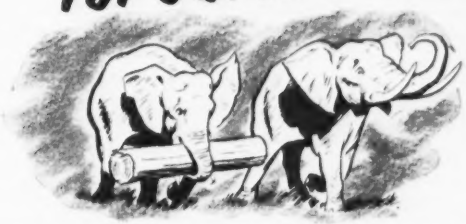
90mm shells, fully loaded, are final-checked on this world's largest jumbo automatic gage.



Gages weighing tons check four, six or eight cylinder block bores simultaneously and classify them in selections of .0002.

Principal auto makers use huge multi-column Precisionaires for the simultaneous checking of as many as 34 dimensions of a crankshaft.

JUMBO GAGES for JUMBO JOBS



Automation in mass production calls for conveyors, machine tools and gaging machines of jumbo size to perform jumbo-size jobs.

Cylinder blocks, crankshafts, camshafts, pistons, rings and pins; push rods, king pins, valve lifters; refrigerator pistons, valve plates and thrust rings; small arms ammunition and artillery shells; roller, pin and ball bearings; jet turbine shafts—these are a few typical jumbo jobs gaged by Sheffield jumbo gages. They indicate how Sheffield helps industry produce greater volume at lower cost—for a more profitable operation.

"The world's foremost authority on production gaging" is a distinction often conferred upon Sheffield by reason of the tremendous volume of such equipment, including jumbo gages, which Sheffield produces.

Sheffield engineers would like to discuss your requirements in every field of gaging. *Gage Division, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.*

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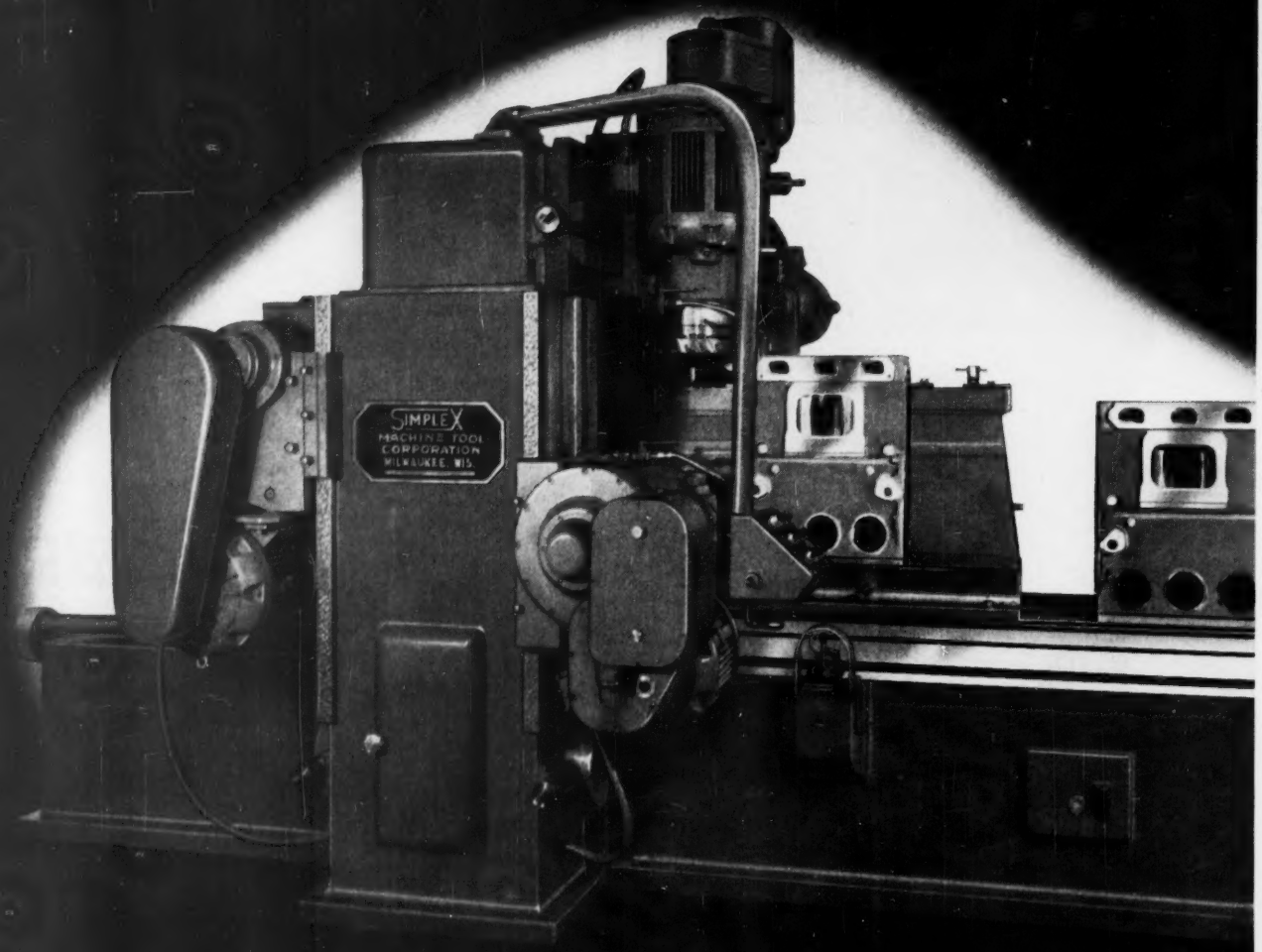
MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD



SIMPLEX HYDRAULIC FEED PLANER TYPE MILLING MACHINE

This 30" wide x 120" stroke planer type milling machine is complete with six unit type milling heads for milling surfaces on 3, 4 and 6 cylinder diesel engine blocks.

Standard hydraulic and mechanical feed planer type milling machines available in sizes from 24" to 48" wide table and from 6' to 16' table stroke.

SIMPLEX MACHINE TOOL CORPORATION

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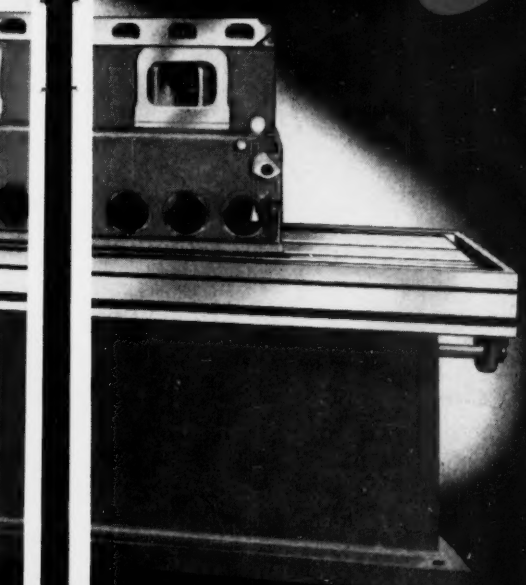
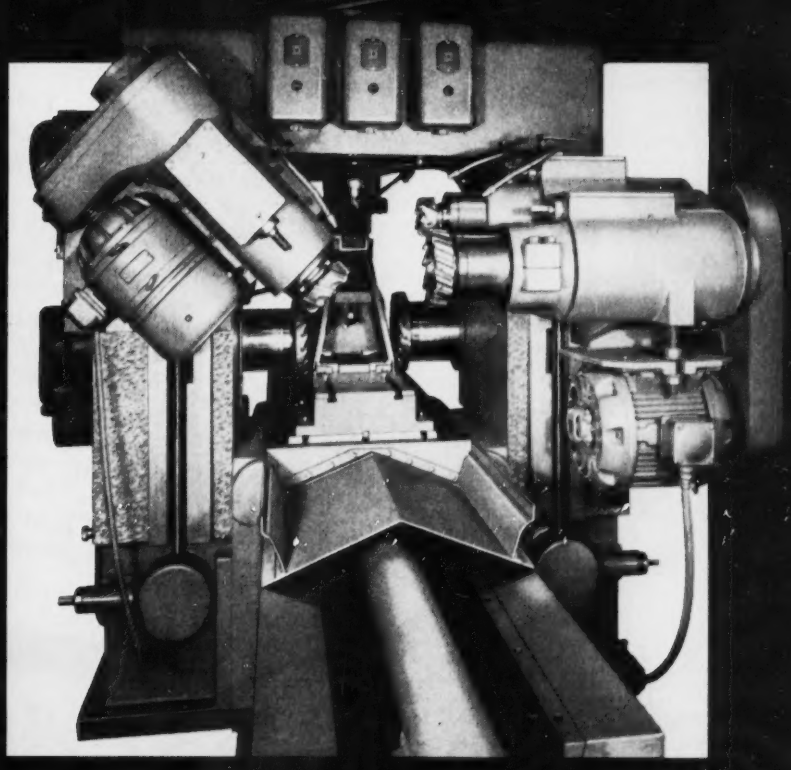
MILWAUKEE, WISCONSIN

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
SPECIAL DRILLING, TAPPING AND BORING MACHINES

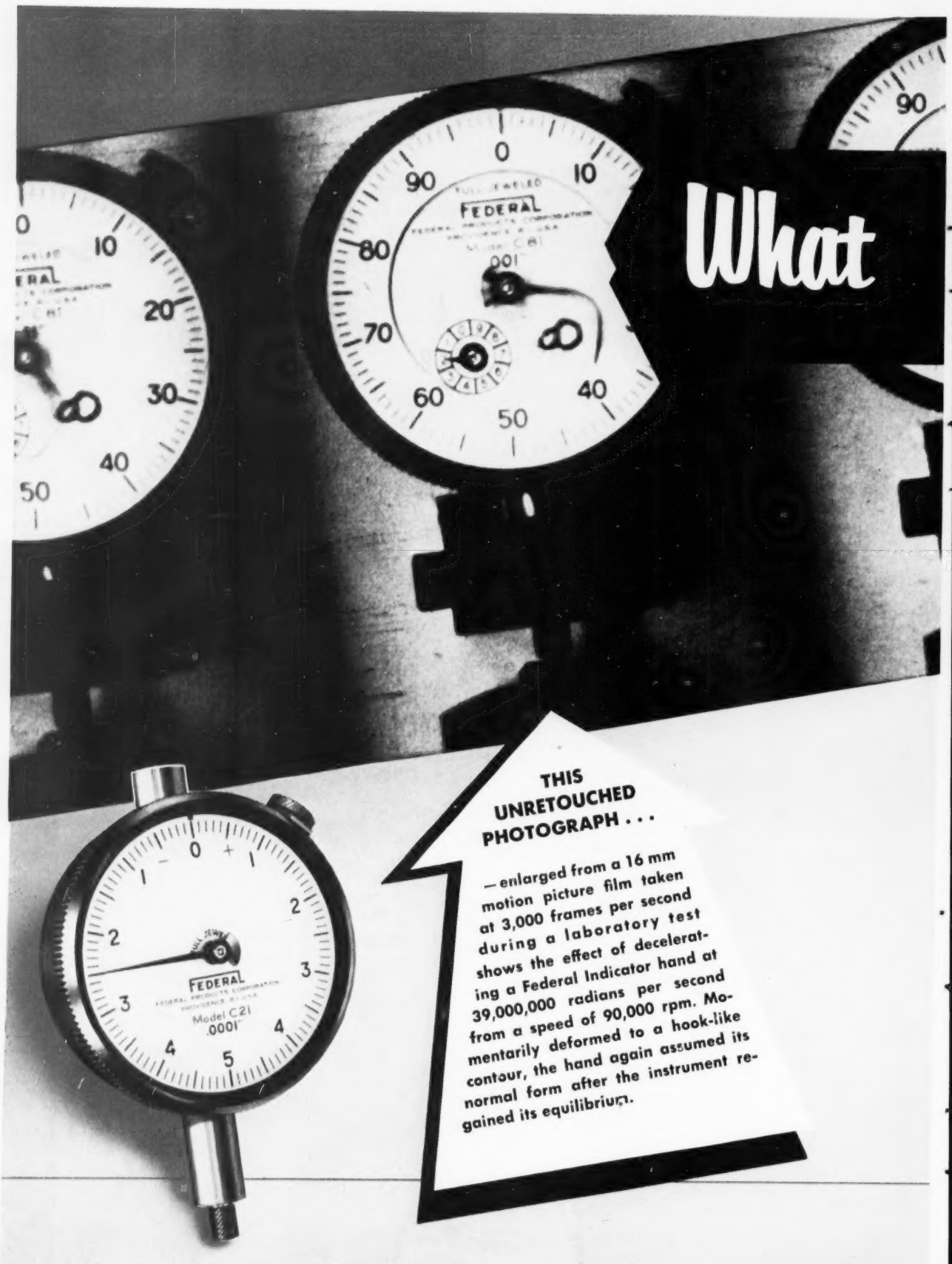
Simplex

PRECISION BORING MACHINES
PLANER TYPE MILLING MACHINES
SPECIAL MACHINE TOOLS





Rear view of above machine showing a unit type milling head mounted at an angle and a two spindle head mounted on the back side of the supporting columns.


What
FEDERAL
Model C.21
.0001"
THIS
UNRETOUCHED
PHOTOGRAPH . . .
—enlarged from a 16 mm motion picture film taken at 3,000 frames per second during a laboratory test shows the effect of decelerating a Federal Indicator hand at 39,000,000 radians per second from a speed of 90,000 rpm. Momentarily deformed to a hook-like contour, the hand again assumed its normal form after the instrument regained its equilibrium.

this test means to YOU!

PROBABLY YOU'VE NEVER STOPPED TO THINK HOW IMPORTANT AN INDICATOR HAND CAN BE . . .

IT IS NOT JUST CONVENTIONAL MODERN DESIGN that makes the hand on a Federal Dial Indicator look as it does!

This high-speed movie shows one of thousands of tests made in our laboratory in a constant effort TO PRODUCE THE FINEST POSSIBLE DIAL INDICATORS FOR YOU. In this destructive test the hand has been momentarily deformed by an excessive blow on the Indicator's contact point.

You naturally ask why we don't just make a stiffer hand. The answer is that a *heavier* hand would increase the inertia and friction within the Indicator and decrease its sensitivity and accuracy. A *lighter* hand would have less inertia but it would not recover its normal straightness after extreme operating conditions. The hand of a Federal Dial Indicator MAINTAINS ITS NORMAL SHAPE.

Furthermore, the hand on a Federal Dial Indicator IS STATICALLY BALANCED to assure a CONSISTENT GAGING PRESSURE against the workpiece. You get a more sensitive Indicator of GREATER REPETITIVE ACCURACY.

This kind of detailed research is typical of the great care that goes into the design and improvement of Federal Dial Indicators and helps to explain WHY FEDERAL IS THE WORLD'S LEADING MANUFACTURER OF DIAL INDICATORS.

It is also very much worth noting that modern manufacturing techniques and Modern Quality Control have enabled us to sell Federal Dial Indicators AT THE SAME LOW PRICE FOR FIFTEEN YEARS. If you haven't our latest catalog showing the most complete line of Dial Indicators of all styles and sizes, write Federal Products Corporation, 1112 Eddy Street, Providence 1, Rhode Island.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL *INDICATING* GAGES

IT'S SO EASY TO TURN A "LONG GRIND" INTO A QUICK, PROFITABLE RUN—

—ON A "BUFFALO" NO. 16 DRILL LIKE THIS

"Fussy" jobs running into thousands of holes, such as the above, drilling graphite lubrication holes in bronze bushings, can be real headaches—but not with this "Buffalo" No. 16 Drill! See how controls, spindle and working table are designed from the operator's point of view. His position is always natural, relaxed. Visibility of work is always good. Accuracy and high output come easily on a "Buffalo" Drill! And this high-quality, medium-price, medium capacity drill is yours in a choice of 3 over-hangs, 8″, 12″ and 15″; sensitive (hand feed) or power feed in one to eight spindles, bench or pedestal models; in up to six spindles. Why not write for Bulletin 2730G and see the many jobs the "16" could be speeding up in *your* plant?

BUFFALO FORGE COMPANY

440 Broadway Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

DRILLING PUNCHING SHEARING BENDING

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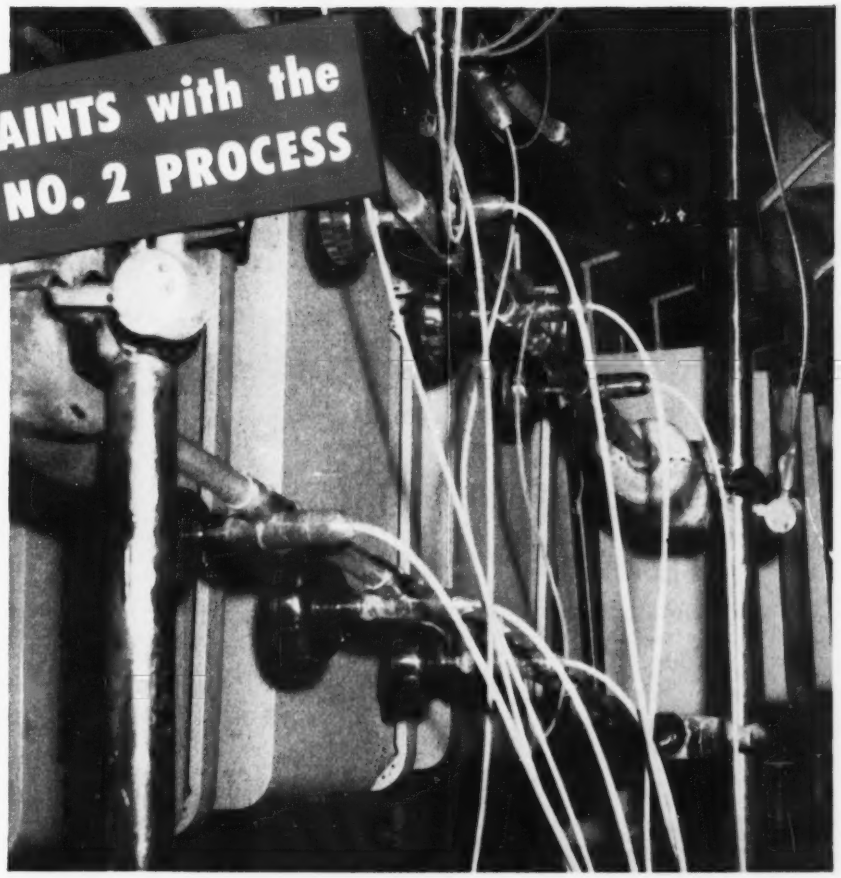
HOTPOINT PAINTS with the RANSBURG NO. 2 PROCESS



One of two stations applying finish paint with No. 2 electrostatic spray in the new, Chicago plant of Hotpoint Co., Division of General Electric. Ransburg's bunching conveyor, with indexing in between paint stations, is used to properly space cabinets, doors, and inner door liners in the electrostatic coating areas.

● It's significant that the first completely new refrigerator plant in 20 years chooses the modern way—the RANSBURG NO. 2 PROCESS—to meet the exacting, high quality standards demanded in the finishing of HOTPOINT REFRIGERATORS.

Today, both large and small industrial plants all over the nation—and abroad—are relying upon the Ransburg No. 2 Process to provide higher efficiencies . . . increased production . . . uniform high quality painting at a fraction of former finishing costs.

RANSBURG

Want to know more about the unmatched efficiencies of the Ransburg No. 2 Process? Write for our brochure describing the No. 2 Process in detail and showing numerous, on-the-line examples of varied installations in factory finishing departments.

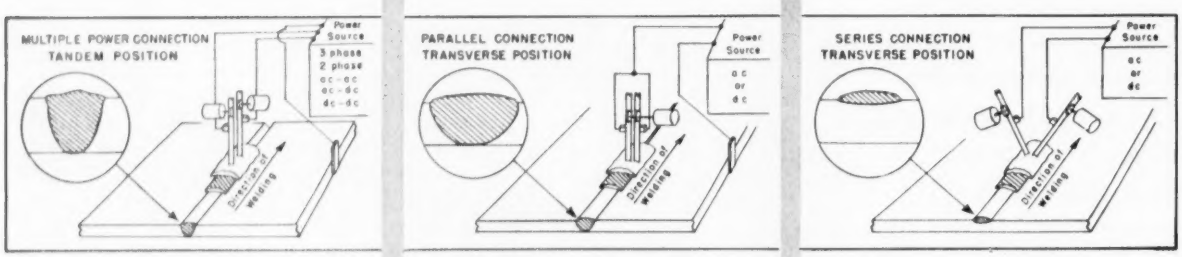
Ransburg **ELECTRO-COATING CORP.**

INDIANAPOLIS 7, INDIANA

CUT YOUR WELDING TIME IN HALF *with* UNIONMELT Multiple Electrode Welding

UNIONMELT Multiple Electrode welding with two or more electrodes in tandem, transverse, or other positions increases welding speeds up to three or four times faster than single electrode welding.

By using two or more electrodes in the same weld zone, magnetic reaction can be regulated to provide exceptional control over arc direction and weld shape.



Extra High-Speed Welds are made with multiple power connection and the electrodes in the tandem position. Speed is three to four times that of single electrode welding. This is particularly suited for welding long continuous seams, well-prepared and well-fitted, as in pipe, tanks, pressure vessels, and structural assemblies.

Extra Wide, High-Speed Welds are made with parallel power connection and the electrodes in the transverse position. Speed is twice as fast as for single electrode work. This is particularly useful for welding seams with gaps or other irregularities, as in center sills, ship plate, and heavy, hard-to-fit work.

Extra Shallow, Wide Welds are made with the series power connection and the electrodes in the transverse position. Speeds are many times faster than single electrode work and the dilution of the deposit is far lower than can be produced with a single electrode. This process will open new possibilities for surfacing and cladding all kinds of articles by automatic welding.

Complete UNIONMELT machines are available for multiple electrode welding and all UNIONMELT apparatus is designed for easy installation in any plant or factory. LINDE'S engineers will be glad to determine how UNIONMELT Multiple Electrode Welding can best benefit you. Call your nearest LINDE office for more details on UNIONMELT Multiple Electrode Welding.

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

Linde TRADE-MARK

The terms "Linde" and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.

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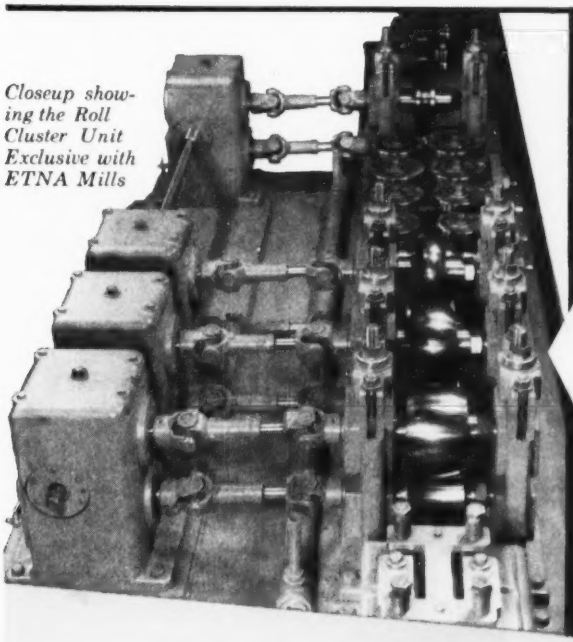
LEADING THE INDUSTRY IN DESIGN...

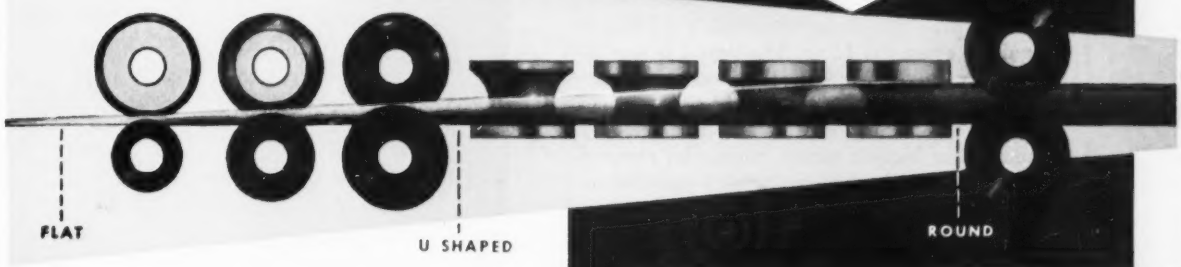


Closeup showing the Roll Cluster Unit Exclusive with ETNA Mills

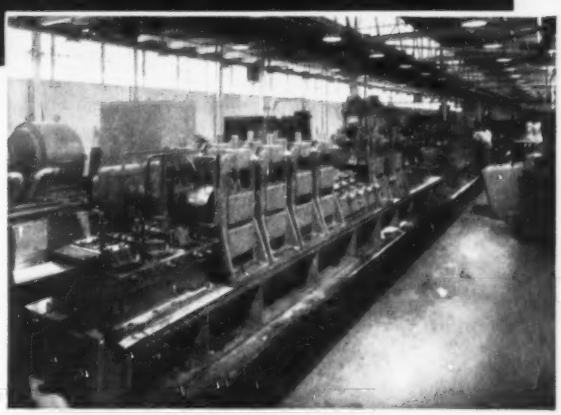
NO MARKING . . . NO SCRATCHING
NO UPSET EDGES . . .

THE Etna METHOD

FOR SMOOTH, WELL FORMED STEEL TUBING



Exclusive with Etna is the cluster unit. This unit progressively rolls the tube into shape without excessive stretching of the edges, thereby eliminating the "buckling" experienced with ordinary tube mills. Etna machines are not forming mills, they are designed for one purpose only . . . to make clear, well formed carbon and stainless steel tubing with no marking, no scratching, no upset edges. Write for complete details.



The ETNA 4KU Mill

Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

IT'S QUIET ON THE MEZZANINE ...WHILE THE MEN BELOW

rivet

...NOT 15 FEET AWAY!

This is a riveting line at the Irving Subway Grating Co., Long Island City, New York. *Yet you cannot hear the riveting!* Why? Because it's done with Hannifin "Hy-Power," the modern cold-squeeze riveting method.

Compact "Hy-Power" Portable Yoke Riveters quietly exert the force. The power is supplied by "Hy-Power" Hydraulic Pressure Generators (you see them right up there beside the man who is consulting the files) . . . compact, single units that include motor, pump, oil reservoir, control valves and high pressure intensifier.

HOW TO REDUCE YOUR RIVETING COSTS

Do it the "silent squeeze" way with Hannifin portable and stationary yoke riveters which are available in capacities from 7½ to 100 tons (more in multiple). It's a fast method. It's a method that assures complete uniformity of every rivet. It's a safe method; for while a touch of a button starts the ram, the stroke may be interrupted and the ram reversed at any point in the cycle, simply by releasing the control button.

See your Hannifin representative who will demonstrate why "Hy-Power" riveting and punching equipment has a place in your production picture. Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Illinois.

WRITE FOR BULLETIN 150

The complete story of Hannifin "Hy-Power" Hydraulics. Your copy sent on request.

do ALL you can do . . . with

HANNIFIN

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

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when M

MICROHONING'S PRECISION HELPS

IN TWENTY-FIVE YEARS the airplane has increased its speed tremendously. Any conception in 1929 of traveling faster than sound was relegated to the fantasy of the comic page.

But stronger metal-alloys, new designs and the development of more accurate metal-processing methods have made "sound-breaking" advances possible. The Microhoning process, which combines stock removal with geometric accuracy, size control and consistent surface finish, is one of the most precise production methods being used.

During the past twenty-five years, in which it has led the honing field, Micromatic has continued to develop its Microhoning process to meet the needs of industry. For example, today, Microhoning's precision is helping the airplane achieve supersonic speeds.

Through such aids as Microhoning, the comic page fantasy has been moved to the front page of reality.

MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

1929 • 1954
25TH YEAR OF DEVELOPMENT
PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC
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REPRESENTATIVES: Allied Northwest Machine Tool Corp., 103 S.W. Front Avenue, Portland 4, Oregon. • Tidewater Supply Co., Charlotte 4, North Carolina.

SUBSIDIARY:
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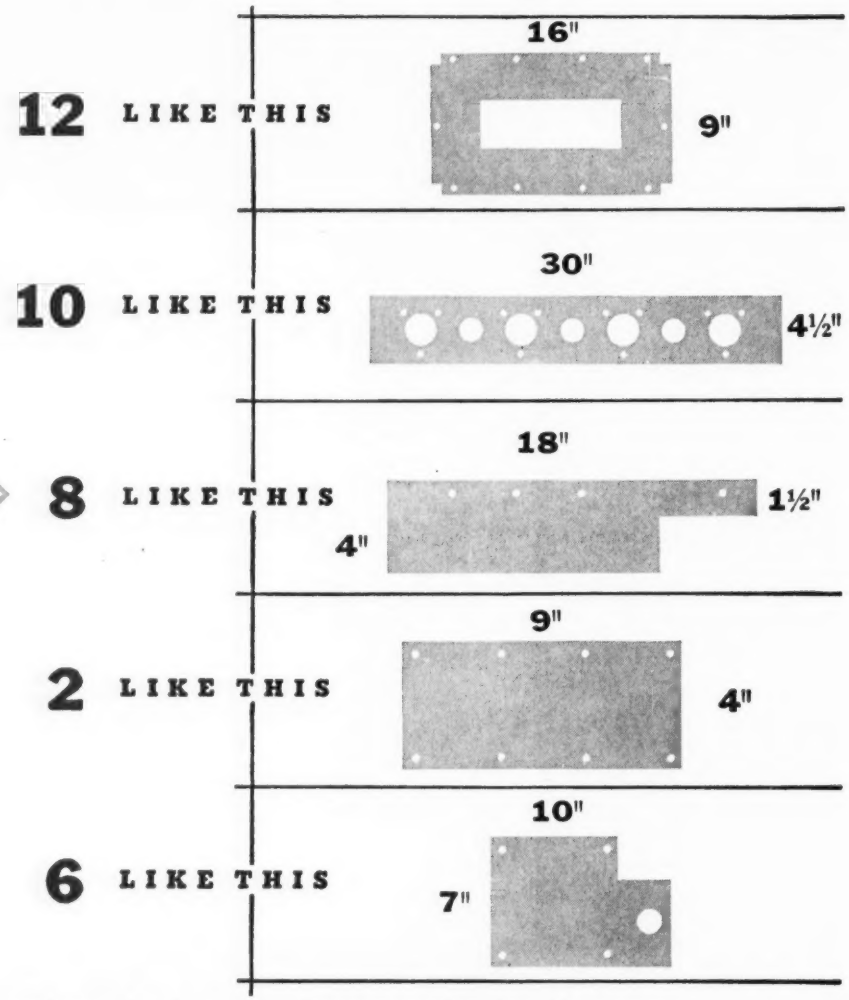
Hydraulic controls • Diesel fuel injection equipment

with a WIEDEMANN you can

Reduce INVENTORY & STORAGE SPACE!

produce parts as required.

All
38
PIECES
were pierced in ⅛" mild steel
IN
28
MINUTES
(including all set-up)



The company producing the above parts has eliminated inventory of these and many other items; has greatly reduced inventory of punches and dies—and they no longer need to stock templates.

The Wiedemann method enables them to ship parts directly to assembly rather than the stockroom.

Items are produced weekly or more often if necessary. Sizes of parts pierced on the Wiedemann range from 5 ft. by 10 ft. down to 2" squares.

Inventory and storage reduction are just two of many cost-reducing features of Wiedemann Turret Punch Presses. We'll gladly make a time study on your own work.

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

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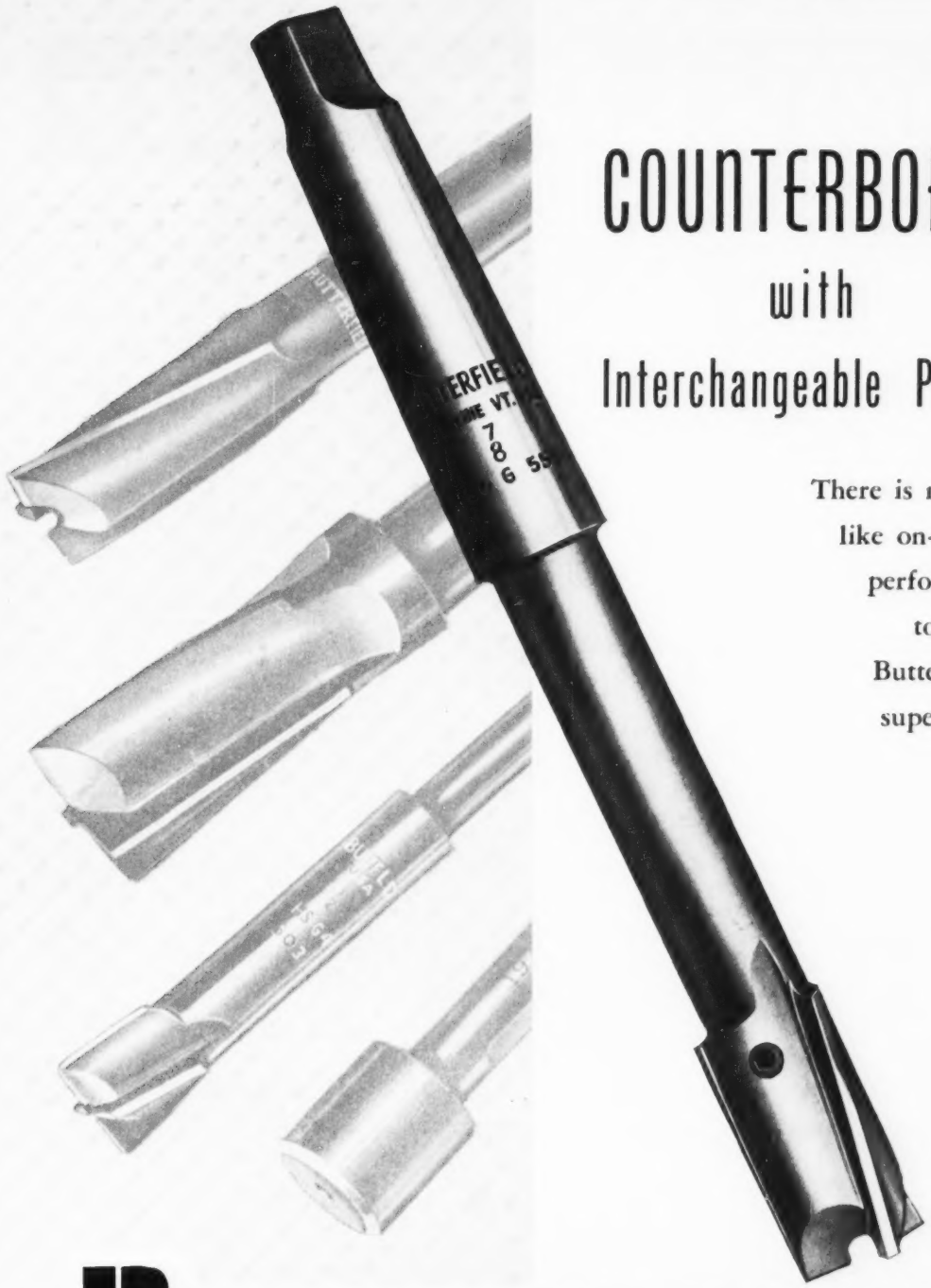

COUNTERBORES with Interchangeable Pilots

There is nothing like on-the-job performance to prove Butterfield's superiority.

BUTTERFIELD

UNION TWIST DRILL COMPANY
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TAPS · DIES · DRILLS · REAMERS · COUNTERBORES · SCREW PLATES

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Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

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ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

ARTER *Precision*

ROTARY SURFACE GRINDERS
for Jet and Piston Engine Airplane Parts

THE MODEL "A"

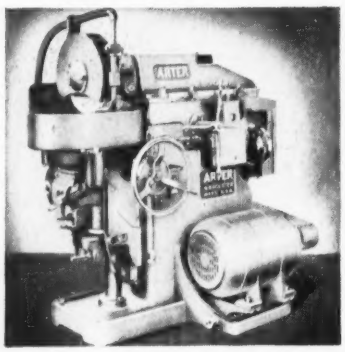
Model "A". Grinding is done on the periphery of the wheel, the work being held by a rotating magnetic chuck. Two sizes: 8" and 12" diameter.

THE MODEL "B"

Model "B". Four chuck capacities — 20", 24", 30" and 40". These machines are mainly hydraulically operated. Great vertical capacity. Work table can be tilted.

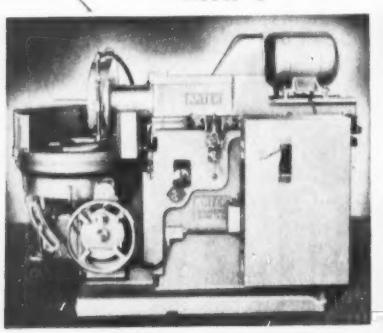
THE MODEL "D"

Model "D" — two chuck capacities — 12" and 16". A 7½ h. p. motor, precision balanced, mounted on the wheel slide delivers full power by multiple vee belts, to the wheel spindle.

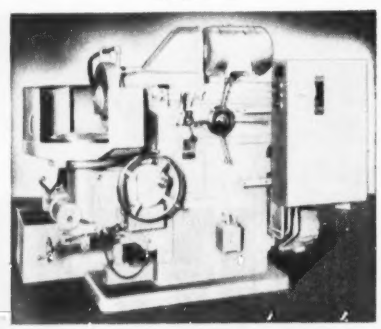


MODEL "A"

MODEL "B"



MODEL "D"



Write today for complete details and specifications

Arter GRINDING MACHINE CO.
WORCESTER 5, MASSACHUSETTS

Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Aluminum
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page* 280)

New!

Farrel-Sykes gear machine generates gears up to 33⅓% faster

greater accuracy—easier to operate

The new Farrel-Sykes "Twin-Head" gear generator cuts gears as much as 33⅓% faster than preceding models, with higher tooth accuracy and finish. This increased speed adds up to important reductions in your manufacturing costs.

In designing the machine, great consideration was given operator convenience. Setup time is reduced, the cutting operation performed automatically—at the touch of a button.

The versatility of the machine is shown by the accompanying list of gears and other parts it can produce. It will handle a maximum range of work with the greatest possible ease, speed, accuracy and economy.

Write for details of this modern gear generator.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.)
Akron, Cleveland, Chicago, Los Angeles, Houston FB-884

Farrel-Birmingham ®

WILL CUT:

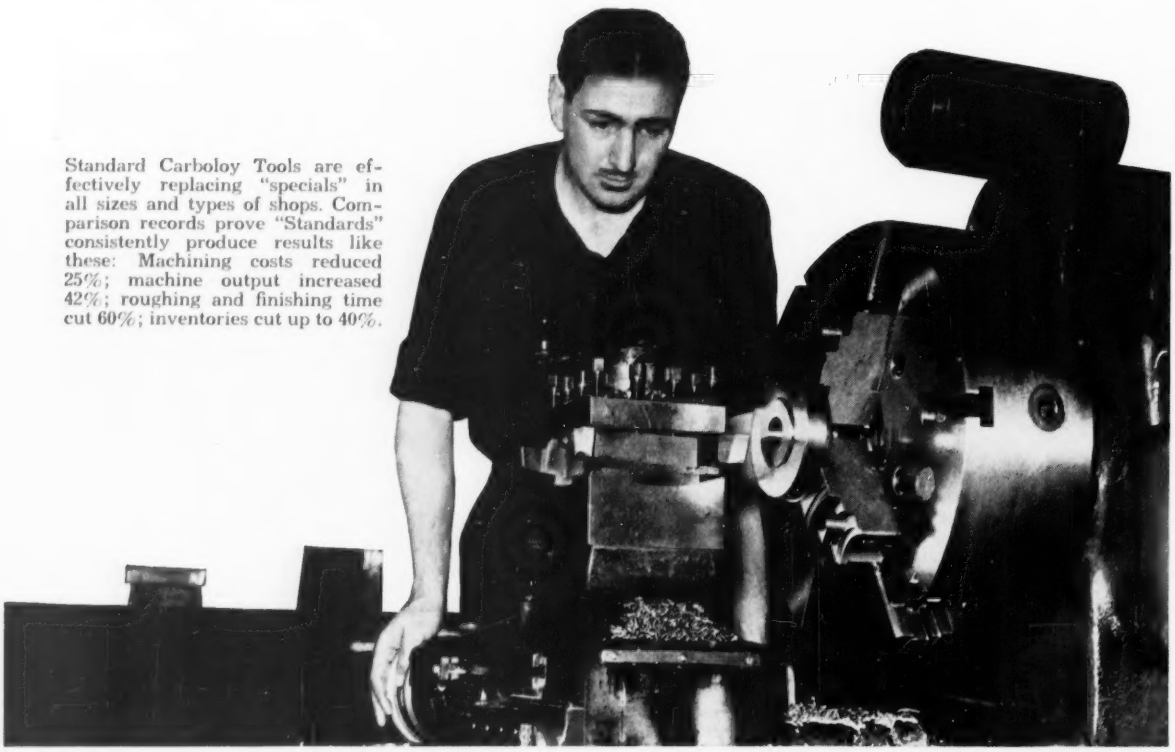
1. Sykes continuous tooth double helical gears
2. Double helical gears with wide or narrow center groove—teeth matched or staggered—helices of similar or dissimilar pitch
3. Single helical gears with external teeth
4. Single helical gears with internal teeth
5. Straight tooth (spur) gears
6. Straight tooth gears with staggered teeth
7. Straight tooth gears with internal teeth
8. Cluster gears
9. Spiral gears
10. Racks (when machine is equipped with special fixture)
11. Sprocket wheels
12. A variety of special contours

STANDARD CARBOLOY® TOOLS

CEMENTED CARBIDE

reduce inventory, increase output, cut production costs on single-point tool jobs

Standard Carboloy Tools are effectively replacing "specials" in all sizes and types of shops. Comparison records prove "Standards" consistently produce results like these: Machining costs reduced 25%; machine output increased 42%; roughing and finishing time cut 60%; inventories cut up to 40%.



JUST ELEVEN Standard Carboloy Tools — styles A to G — will do up to 80% of all single-point tool jobs . . . outlast steel tools by as much as 10 to 1. Use them "as is" for turning, facing, boring . . . or adapt them quickly to your own "specials."

By using "Standards" you'll eliminate hundreds of costly, inventory-loading special tools. You'll slash downtime to an absolute minimum. Your local Authorized Carboloy Distributor can always give you immediate delivery on all Standard Tools and blanks, insert blanks and boring tools.

Standard Carboloy Tools are available to handle every single-point tool job. Send coupon, today, for free technical literature.

CARBOLOY
Department of General Electric Company
11147 E. 8 Mile Ave., Detroit 32, Michigan

Send me the following, without cost or obligation:

- ☐ Application data on Grade 370.
- ☐ "Brief-A-Log" Condensed Catalog and Price List, GT-265, with "Standard" specifications.
- ☐ Have a tool expert call to show us how to use "Standards" effectively.

Name _____ Position _____

Company _____

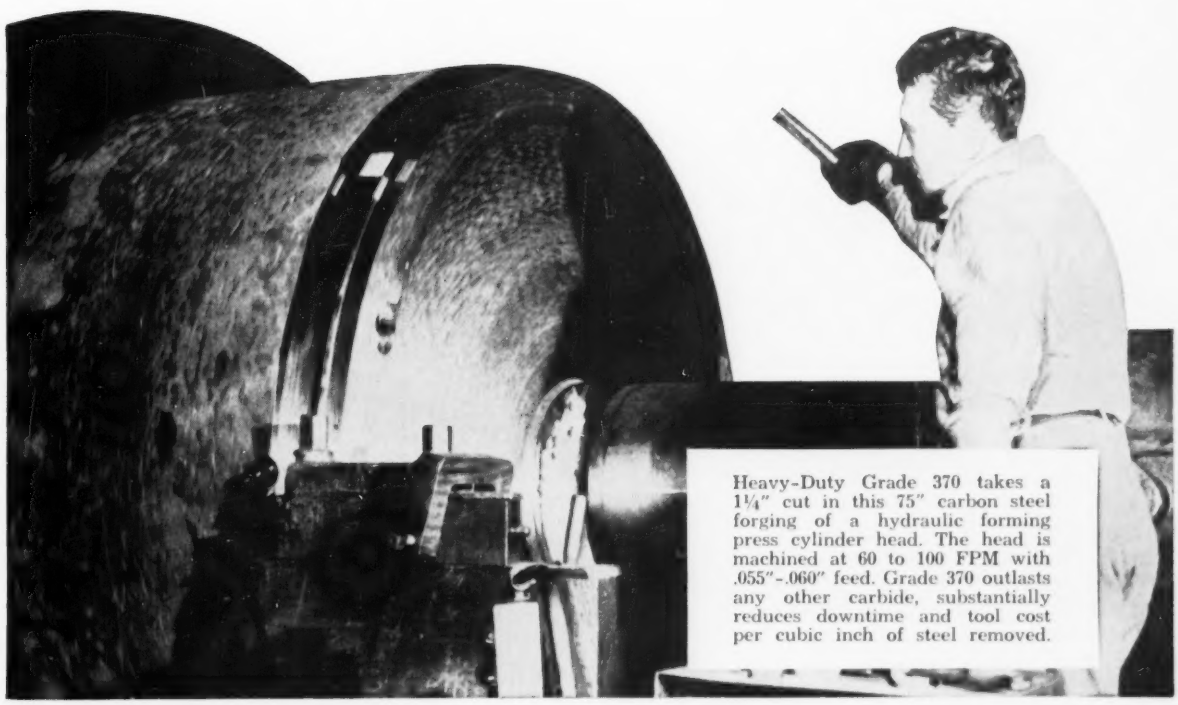
Address _____

City _____ Zone _____ State _____

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

NEW CARBOLOY® GRADE 370
CEMENTED CARBIDE

cuts more cubic inches of steel per minute—with longer tool life—than any other carbide



Heavy-Duty Grade 370 takes a 1¼" cut in this 75" carbon steel forging of a hydraulic forming press cylinder head. The head is machined at 60 to 100 FPM with .055"-.060" feed. Grade 370 outlasts any other carbide, substantially reduces downtime and tool cost per cubic inch of steel removed.

NEW Heavy-Duty Grade 370 Carboloy cemented carbide was specially developed for taking heavier cuts in steel, at higher speeds than ever before practical. Grade 370 cuts more cubic inches of steel per minute – with longer tool life – than *any* existing carbide.

Other carbides fail when machining at higher speeds because the tremendous temperatures and pressures deform their cutting edges. Heavy-Duty Grade 370, manufactured by an entirely new process, has a built-in rigidity to resist this deformation, even at temperatures of around 1800° F.

Carboloy Grade 370 is being used successfully on such tough, heavy-duty applications as rolls, gun barrels and locomotive wheels. Grade 370 lasts longer than any other carbide – *increases production by as much as 30%.*

The first of the new Series 300 steel-cutting carbides, Heavy-Duty Grade 370 is available immediately in a number of sizes and shapes. Trained engineers from the Carboloy Engineering Appraisal Service will work with you on your heavy-duty cutting jobs. Send coupon at left, for information, and for free technical literature.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

ACCO products

WILSON "Rockwell"* Hardness Testers

NOW FOR ONLY

$550

(less accessories, F. O. B. Bridgeport)

you can get this

J-MODEL WILSON "Rockwell"

The Best...Costs Less...to Use

• When you use WILSON "*Rockwell*" Hardness Testers to check your products during various stages of manufacture, you will *be sure*. You will prevent costly complaints from your customers. The long experience of WILSON'S Standardizing Laboratory engineers is your assurance of top quality and accuracy in the "*Rockwell*" Testers you buy.

Six Important Features

1 Totally enclosed, dirt and dust-proof "Zerominder" dial gauge
2 Gripsel clamp screw for quick change and proper seating of penetrator
3 All controls grouped conveniently
4 Enclosed, easy-to-reach variable speed dash pot
5 Stainless steel elevating screw
6 Standardized weights

WILSON Makes a Complete Line

There are two types of WILSON "*Rockwell*" Hardness Testers . . . Regular and Superficial. They come in many styles with accessories for testing flats, rods, rounds, and odd shapes. For micro-indentation hardness testing, there is the WILSON TUKON.

Write for information and let us make recommendations

*Trade Mark Registered

ACCO

WILSON MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

230-D Park Avenue, New York 17, N. Y.

WILSON "ROCKWELL" and TUKON Hardness Testers

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T. & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

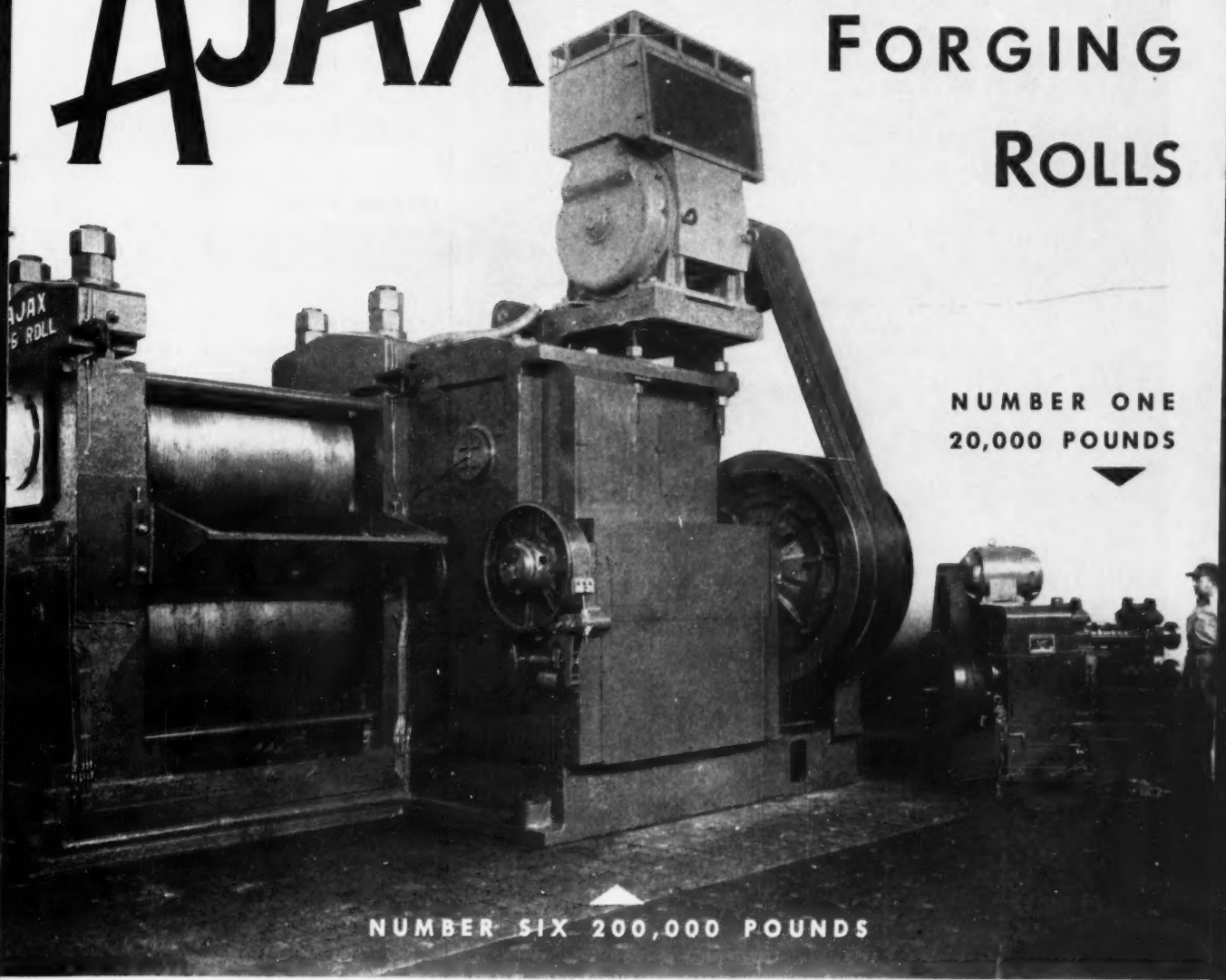
BEARINGS, Ball

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 282)

For more information on products advertised, use Inquiry Card, page 243

AJAX COMBINATION DIE FORGING ROLLS



NUMBER SIX specifically used for forging aircraft components. 200,000 pound AJAX FORGING ROLL shown at the left and foreground above is designed for pre-rolling blanks for subsequent DROP forgings.

NUMBER ONE universally used in aircraft, automotive, agricultural industries. 20,000 pound AJAX FORGING ROLL shown at the right above is designed for rolling reduced tapered and straight forgings and pre-rolling blanks for subsequent PRESS forgings.

BUILT IN SIX SIZES FROM NUMBER 0 TO NUMBER 6.
ILLUSTRATED AND DESCRIBED IN BULLETIN 91A.

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST. CHICAGO 3, ILLINOIS
DEWART BUILDING NEW LONDON, CONN.

Waterproof! switch
new CPI basic snap-action
METAL ACTUATING BUTTON
METAL SWITCH CASING
SILICONE, NEOPRENE, or VINYL CASING
SINE CURVE SNAP-ACTION ELEMENT
Normally Closed STATIONARY CONTACT
Normally Open STATIONARY CONTACT
Features complete sealing from effects of water, dirt and oils • Vibration resistant up to 240 g's • No resonance up to 7000 C.P.S. • Will take 2000 ft. lbs. shock test • Rated 10 amperes resistive 28 V. D.C. or 115 A.C. • Actuators made to fit individual requirements • Silicone, neoprene or vinyl molded cases • Wire leads from 6 inches to 48 inches optional
CONTROL PRODUCTS • INC.
320 SUSSEX STREET • HARRISON • NEW JERSEY
Manufacturers of Thermal Devices and Waterproof Switches

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle

Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller

Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, TRANSMISSION

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page* 284)

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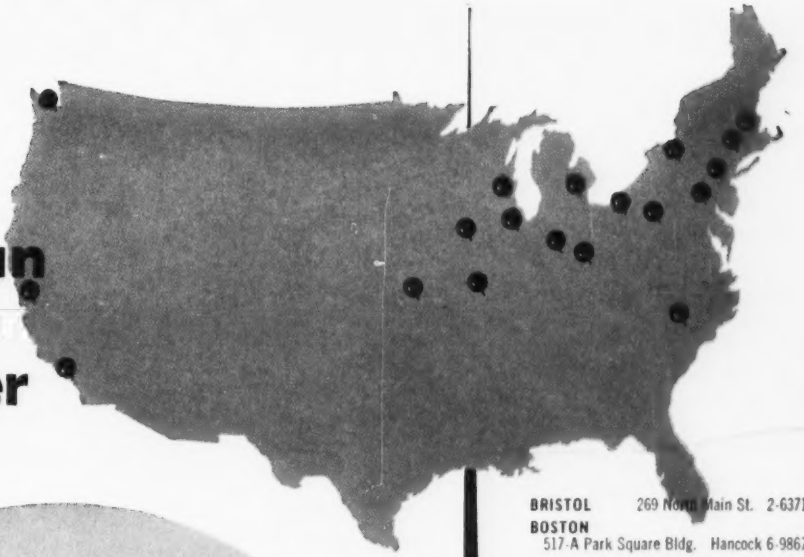
every salesman an engineer



BRISTOL 269 North Main St. 2-6371
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PHILADELPHIA
850 East Luzerne St. Garfield 3-4136
SYRACUSE 2360 James St. 73-5195
DETROIT
7-122 General Motors Bldg. Trinity 2-4700
CINCINNATI
2107 Carew Tower Main 5783
CLEVELAND
3113 W. 110th St. Winston 1-5454
INDIANAPOLIS
1357 W. 18th St. Imperial 4680
PITTSBURGH
Cathedral Mansions Mayflower 1-8100
CHICAGO
332 So. Michigan Ave. Wabash 2-5875
DAVENPORT
2212 E. 12th St. Davenport 7-7522
KANSAS CITY
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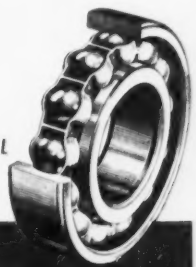
MILWAUKEE
647 W. Virginia St. Broadway 6-9460
ST. LOUIS
3001 Washington Blvd. Franklin 6533
LOS ANGELES
5035 Gifford Ave. Logan 8-2301
BERKELEY
1716 Fourth St. Landscape 6-8750
SEATTLE 5000 First Ave., S. Lander 5920

NOTHING ROLLS LIKE A BALL

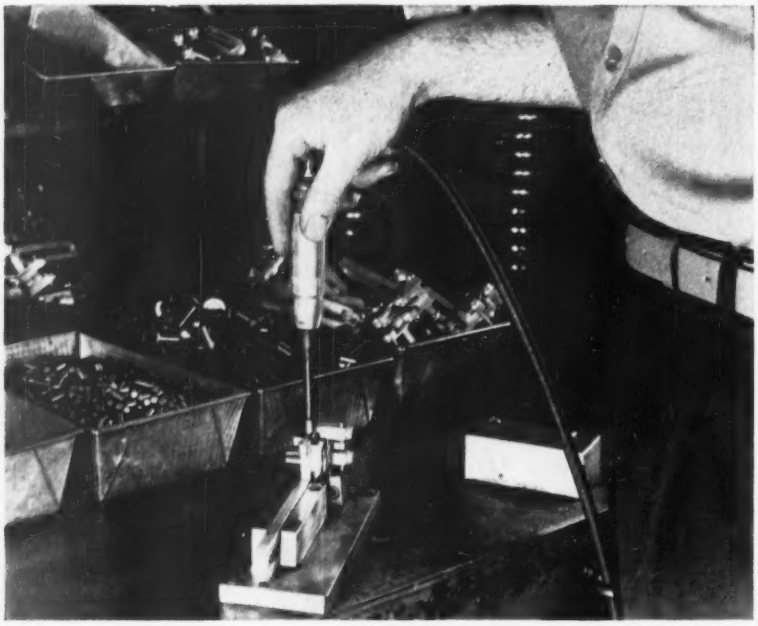


Close at hand to *lend* a hand! Whenever a design calls for **ball** bearings, call in your New Departure sales *engineer*. You'll find that he's a specialist in solving anti-friction problems. You'll find, too, that he cooperates efficiently with your designers and engineers. He's backed by the industry's most complete research and manufacturing facilities. *Whatever your* **ball** *bearing needs, be sure to talk them over with a New Departure sales engineer.*

NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT
Plants also in Meriden, Connecticut, and Sandusky, Ohio

For more information on products advertised, use Inquiry Card, page 243



Saves ⅔ of Assembly Time with this 10-ounce KELLER SCREW DRIVER

The Keller Pneumatic Screw Driver shown above—Model 12D-2C—is used in assembling parts for a power band saw. It has increased production per man-hour to three times as much as it was before. Similar results are reported from other shops where it has been installed.

It is lightweight (10 oz) and well proportioned to fit the operator's hand. It has pneumatic pick-up and a pressure control. It is so easy to handle and use that it makes assembly a breeze.

Facts in Brief about KELLER Screw Drivers

- Weigh less—reduce fatigue
- Consume less air
- Interchangeable parts—wide variety of handles, gearings, torques, speeds
- Clutches, 45° and 90° attachments for every requirement

Send for descriptive literature and detailed information

KELLER TOOL COMPANY

GRAND HAVEN, MICHIGAN

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave. Buffalo, N. Y.
Watson [illegible] Co., Div. H. K. Porter Co., Inc [illegible], N. J.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York Pa.
Pines Engineering Co., Inc., Aurora, Ill. (Hydraulic)
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BLUING LAYOUT
Dykem Co., 2303 P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

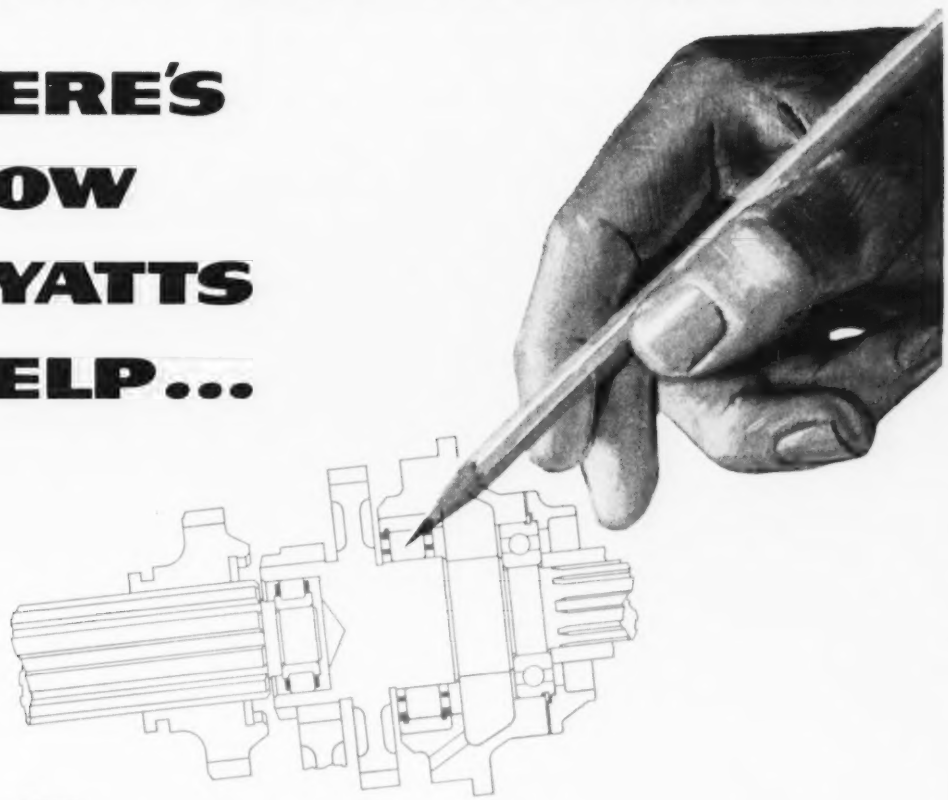
BOLTS, T-Slot
O. K. Tool Co., Milford, N. H.

(*Continued on page* 286)

For more information on products advertised, use Inquiry Card, page 243

when LIMITED SPACE is a design factor

HERE'S HOW HYATTS HELP...

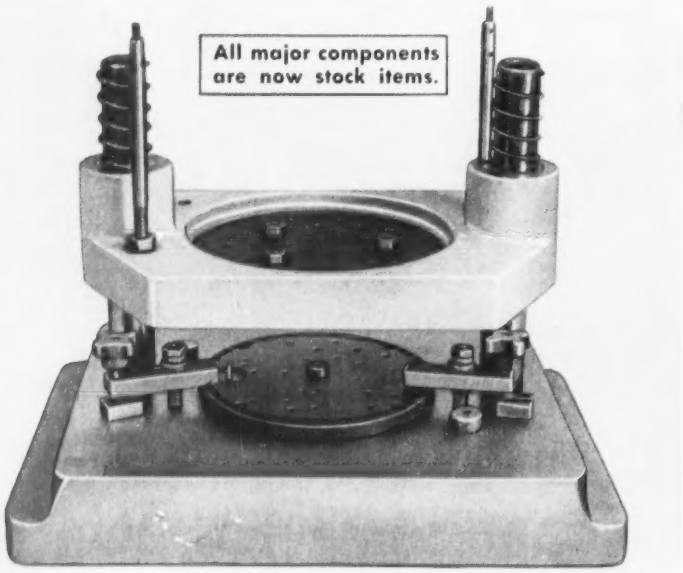


Sometimes a fraction of an inch is the difference between a simple design modification and costly re-tooling. And the engineer who is thoroughly familiar with Hyatt Roller Bearings will know a lot about how to save those fractions. He'll know, for example, that to gain greater shaft rigidity with the same size housing, he need only check his Hyatt catalog for a separable inner race type of bearing. This type—available in a wide range of sizes—may be applied with the rollers operating directly upon the surface of a suitably hardened and ground shaft. Thus, a larger-diameter shaft may be used without sacrificing bearing capacity, or a larger-size bearing may be used without changing the size of the shaft. For a copy of Hyatt's latest catalog, No. 150, write to Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

STRAIGHT ◯ BARREL ◯ TAPER ◯

HERE'S THE NEW Zagar Standardized Self-Clamping DRILL JIG

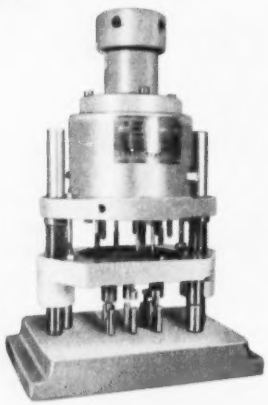


Zagar Drill Jigs are used in conjunction with Zagar gearless multiple-spindle drill heads to ream, drill and tap on standard drill presses and tapping machines

NOTHING ELSE LIKE IT!

4 TYPES — 9 SIZES,
5 COMBINATIONS PER SIZE —
Hole Patterns 3" through 15" Dia.

SPEEDY — ACCURATE — RUGGED



▲ Zagar 15-spindle, 7" diameter gearless drill head mounted on Zagar standardized drill jig drills 15 holes in aircraft part.

A new concept to reach new production highs! Standardization means quick delivery and attractive price, since only a very few minor parts have to be made. Extremely fast; the operator merely feeds the parts — the Zagar Self-clamping Drill Jig does the rest. Proven design insures maximum accuracy.

ASK FOR OUR NEW DATA SHEET M-2

ZAGAR TOOL, INC. 24000 LAKELAND BLVD., CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

BOOKS, Technical
Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., N. Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical
American Steel Foundries King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal
(Floor, Planer or Table Types)
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kennedy Corp., 1620-A Dime Bldg., Detroit 26, Mich.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.

(*Continued on page* 288)

For more information on products advertised, use Inquiry Card, page 243

for Precision
+ Low Cost:

MIKRON

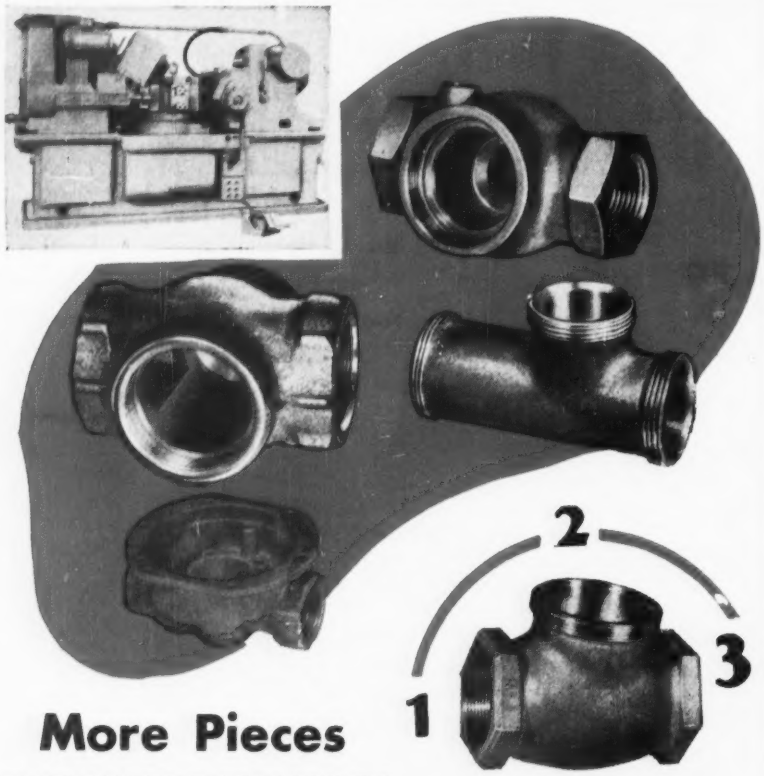
GEAR HOBBER #79

Mikron Hobbing Machines Excel Where High Precision Machining Standards Must Be Maintained

• **MIKRON No. 79** is an excellent choice for small spur gears and pinions. It is simple to operate, to set-up and to change-over from job to job. **CAPACITY:** Gears, max. dia. $1\frac{9}{16}$"; max. length of cut $1\frac{1}{8}$"; number of teeth 6 to 390; pitch DP 26 and finer.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



More Pieces COMPLETELY *finished in less time on* GOSS & DeLEEUW AUTOMATIC CHUCKERS

This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling.

The "1-2-3" exclusive Goss & De Leeuw feature provides for finish machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

●

Send for illustrated literature which fully describes this recent Goss & De Leeuw development in chuckers. Submit samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS *and* DE LEEUW
MACHINE COMPANY, *KENSINGTON, CONN., U.S.A*

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Mummert-Dixon Co., Hanover, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kennedy Corp., 1620-A Dime Bldg., Detroit 26, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippit Corp., N. Tonawanda, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.

(*Continued on page* 290)

For more information on products advertised, use Inquiry Card, page 243

"Who builds your 'CUSTOM' cylinders?"

"HANNIFIN DOES ... AND THEY DESIGN THEM, TOO!"

Yes, Hannifin designs and builds custom cylinders to the exact—and often extraordinary—specifications of manufacturers in many fields. (See chart at right for typical examples.)

Experienced buyers know that custom cylinders offer these distinct advantages. One, custom cylinders will exactly fit a given space or perfectly mate with another part. Two, custom cylinders may be designed for special operating conditions. Third, custom cylinders, when used in quantity, frequently cost less money.

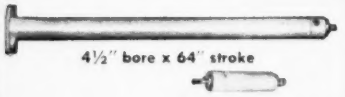
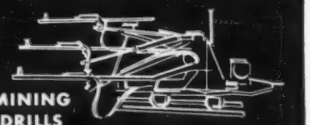
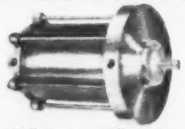
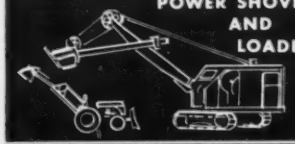
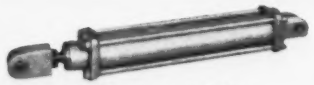
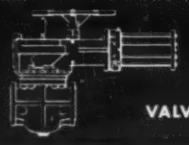
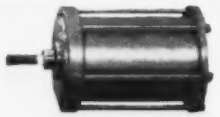
Why not have your design engineers consult with Hannifin. The Hannifin line of standard hydraulic cylinders is the most complete in the industry. Hannifin, with its broad experience, has the knowledge either to recommend the correct standard cylinder for your machines, or to design and build a quality custom cylinder at lowest possible cost.

See your Hannifin Sales Engineer ... or write for information—

HANNIFIN

Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units
Pneumatic and Hydraulic Presses • Air Control Valves

TYPICAL PRODUCTS	TYPICAL CYLINDERS	TYPICAL USES
LIFT TRUCKS	 4½" bore x 64" stroke 4" bore x 7½" stroke	On lift trucks, hydraulic cylinders hoist and tilt the load, actuate special grabs and other attachments.
BULLDOZERS	5" bore x 24" stroke	On bulldozers and other blade-type equipment, hydraulic cylinders are used to lift, lower and position the blade.
 MINING DRILLS	3½" bore x 10" stroke	On mining drills, hydraulic cylinders position the drill arms, level the unit, hold the machine steady while drilling.
LATHES	 6½" bore x 10" stroke	On lathes, pneumatic or hydraulic cylinders advance tail stock on automatics, bring entire head assembly into position on turrets.
POWER SHOVELS AND LOADERS 	7" bore x 47¾" stroke	On power shovels and loaders, hydraulic cylinders perform such important functions as digging, leveling, lifting, steering and turning.
FARM MACHINERY	 2½" bore x 14" stroke	On farm machinery, hydraulic cylinders actuate swing, grab, lift and steering mechanisms, position plow and harrow blades.
 VALVES	 8" bore x 10¾" stroke	On large valves, pneumatic or hydraulic cylinders provide automatic operation, are much used where electric operation might be hazardous.

For more information on products advertised, use Inquiry Card, page 243

AMES

...the preferred

Ames Long Range Dial Indicator No. 262

... not because they cost more (in the long run they're more economical) but because they're completely *impersonal*. They do their measuring jobs absolutely independent of the human hand.

For more than 50 years, Ames Micrometer Dial Gauges and Indicators have kept pace with increasingly critical precision requirements. Today, each part of every Ames product is carefully built by exclusive Ames methods and machines from the materials best suited to its function — and 100% checked for accuracy. As a result, all Ames products are extremely accurate and sensitive, yet rugged and tough — to give you *longer* service with *less* down-time.

Send today for your free copy of Catalog No. 58

Representatives in principal cities. B. C. AMES CO. *27 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Detroit Broach Co., 20201 Sherwood Ave., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Thor Power Tool Co., Aurora, Ill.

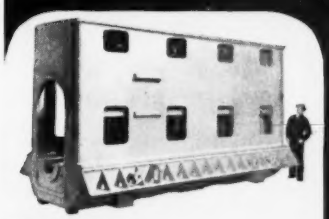
BULLDOZERS

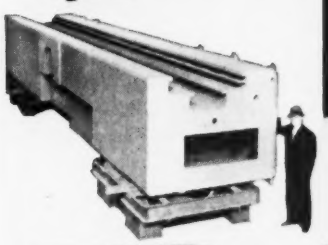
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

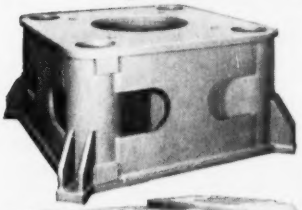
(*Continued on page* 292)

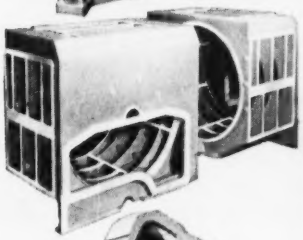
For more information on products advertised, use Inquiry Card, page 243

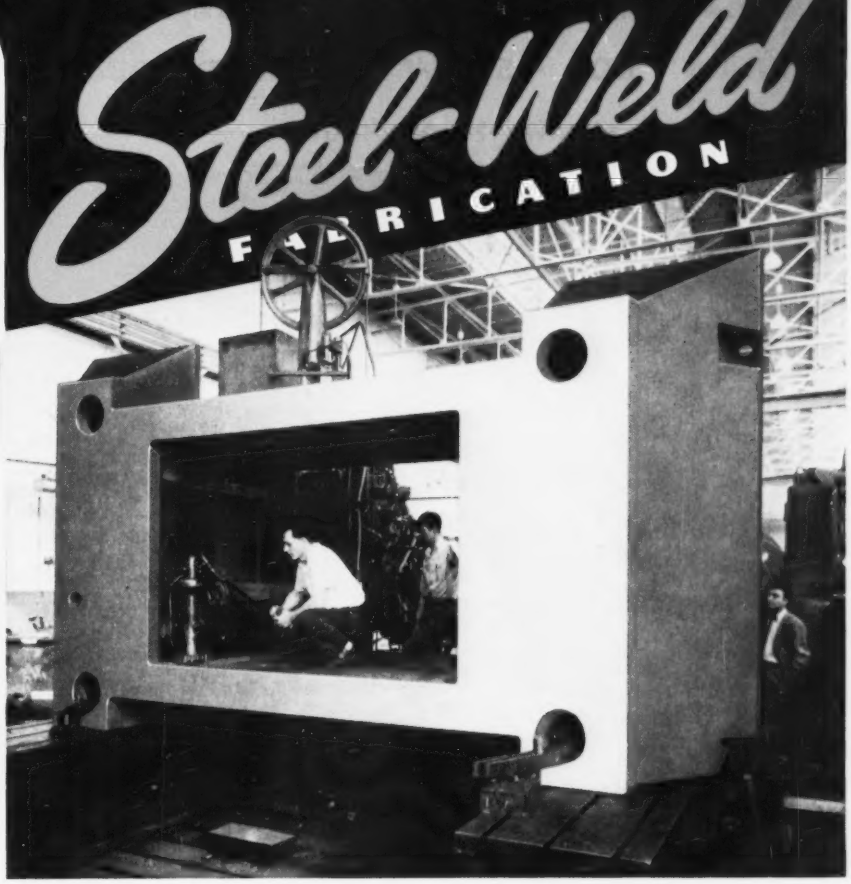
Steel-Weld FABRICATION

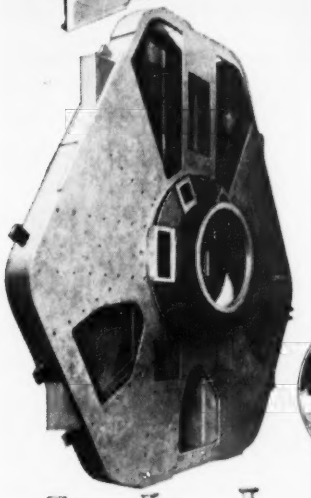


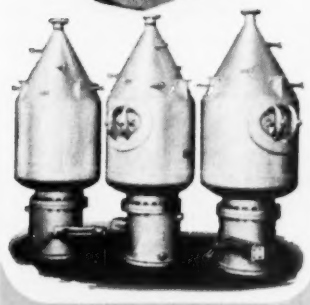












Here is another heavy Steel-Weld Fabricated piece produced and machined to specifications by Mahon. This and the parts and assemblies illustrated at the left are typical of thousands of Steel-Weld Fabricated units produced and machined by The R. C. Mahon Company for hundreds of manufacturers of machine tools and other types of heavy mechanical equipment. If parts of your product could be produced to better advantage through Steel-Weld Fabrication, or, if you require large, heavy pieces where pattern costs and the time element are a consideration, you can turn to Mahon with complete confidence . . . personnel and facilities are available within the Mahon plant to do the complete job from drawing board to finished machining. You will find in the Mahon organization a unique source with complete ultra-modern fabricating, machining and handling facilities to cope with any type of work regardless of size or weight . . . a source where skillful designing and advanced fabricating technique are supplemented by craftsmanship which assures a smoother, finer appearing job embodying every advantage of Steel-Weld Fabrication. See Mahon's Insert in Sweet's Product Design File, or write for further information.

Use WELDED STEEL for Greater Strength with Less Weight!

THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON

MUELLER BRASS CO.

600 SERIES BEARING ALLOYS

FORGINGS • ROD • SCREW MACHINE PRODUCTS

proving their quality throughout

American industry

Mueller Brass Co. "600" series bearing bronzes are lightweight, high strength copper-zinc base alloys with excellent bearing and mechanical properties, non-galling and non-seizing characteristics and good resistance to corrosion. They have a dense, homogeneous structure that reduces machining time and metal waste and increases tool life. As bearings, gears, connecting rods, cams and other parts, they will generally save you considerable money and outperform and outlast the cast phosphor bronzes. Write today for complete information about the MUELLER BRASS CO. "600" series alloys for forgings, rod or screw machine products.

six members of "600" series . . . one for every purpose

There are six members in the "600" series group, and they possess fundamentally similar characteristics. But slight differences in the properties of each are produced through variations in the basic formula. Thus, each metal is best suited to perform a specific set of functions. And as a group, they are suitable for a wide range of applications.

119

MUELLER BRASS CO. PORT HURON 35, MICHIGAN

Chambersburg Engrg. Co., Chambersburg, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Ptitsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kux Mch. Co., 3930-44 W. Harrison St., Chicago, Ill.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 294)

McCROSKY

1904-1954 — COST CUTTING TOOLS — 50TH ANNIVERSARY

Jack-Lock®
MILLING CUTTERS

Face Mills, Shank and Shell End Mills, Half Side and Staggered Tooth Designs

Standard Sizes from 3" to 24" in Diameter

Carbide Tipped or High Speed Blades for Cast Iron, Steel and Aluminum

Engineered to match the ruggedness and power potential of modern milling machines, McCrosky Jack-Lock® cutters feature a proved design that gives you a maximum of long, highly efficient and trouble-free service.

McCrosky's nationally known Jack-Lock® wedges hold the blades rigidly and solidly in the body with a powerful compound action; yet permit easy, quick release of the blades; and relocking again, rigidly and solidly, without hammering or pounding.

Fine pitch adjusting screws permit the blades to be advanced evenly and accurately against an indicator, reducing to a minimum the amount of blade stock lost in regrinding; saving grinding time; minimizing purchases of new blades; and enabling fewer cutters to keep a job running continuously.

Sizes and designs for every milling requirement. Write for Bulletin No. 17-M and start today cutting your milling costs with McCrosky cost cutting Jack-Lock® milling cutters.

McCROSKY *Universal*
MILLING CUTTERS

Body can be bladed to rotate either right or left hand. Consequently, selecting blades with tips of proper material mounted at proper angles produces a cutter that meets any metal or machine condition. Write for Bulletin No. 531 today.

McCROSKY *Super® Adjustable*
REAMERS

Complete line includes chucking reamers with straight or tapered shanks, shell reamers with tapered holes for standard arbors or large straight holes for line bar reaming. Stock sizes from 15/16" to 6" diameter. High speed, cast alloy or carbide tipped blades. Write for Bulletin 18-R.

McCROSKY *Wizard®*
QUICK-CHANGE CHUCKS

McCrosky's Wizard Quick-Change Chuck and Collet outfits hold tools centered and rigid. They enable the operator to change tools easily and quickly, without stopping or slowing down the spindle. Successive operation jobs become continuous. Write for Bulletin 18-C.

McCROSKY *Turret*
TOOL POSTS

These tool posts permit successive tools to be swung into cutting position quickly, indexed accurately, and locked rigidly, giving engine lathes many of the advantages of turret lathes. Four styles—11 sizes. Write for Bulletin 18-T.

McCROSKY *Block Type*
BORING BARS

Individually ground and hardened tapered V-key centers the block and cutting blades accurately and rigidly yet permits easy release for regrinding, and "floating" with extreme accuracy when making finishing cuts. Wide range of stock sizes. Write for Bul. 18-B.

McCROSKY *Multiple Operation*
TOOLS

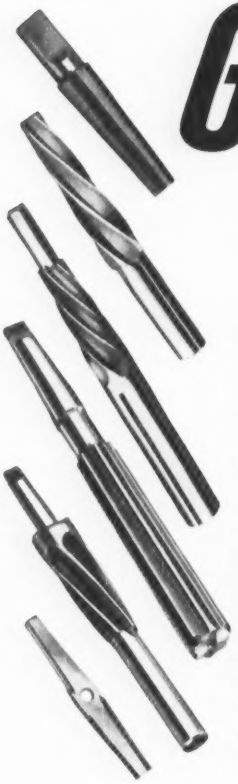
McCrosky "Specials" combine two or more related boring, facing, chamfering or reaming operations into a single tool saving set-up time and cutting costs. Engineered by McCrosky to your work prints. Write for Bulletin 17-S.

COST CUTTING TOOLS — **McCROSKY TOOL CORPORATION**
MEADVILLE, PA.

Engineering and Sales Representatives in the Principal Cities

FOR SPECIAL REAMERS . . . REMEMBER

GORHAM



They may not *look* alike, but all of the special tools on this page share a common function . . . *because every one is a reamer!* Each was engineered and manufactured by Gorham Tool Company to provide a practical solution to a specific production machining problem for one of our customers.

Actually, these reamers represent just a few of the many special-purpose cutting tools produced by Gorham. Others include milling cutters and end mills, inserted blade cutters, flat and circular form tools, profile cutters, and carbide tipped tools of every description. Gorham "specials" are turning problems into profits in thousands of plants every day . . . and the one we engineer for you will solve *your* next production machining problem, too! Take advantage of our experience.

Your nearby Gorham Field Engineer is a qualified cutting tool expert in both practical design and actual application, and his assistance is yours without obligation. Just write for his name, or send details of your problem direct to us. We'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON • DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, IRON
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Hansell-Elcock Co., 485 W. 23rd Place, Chicago 16, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

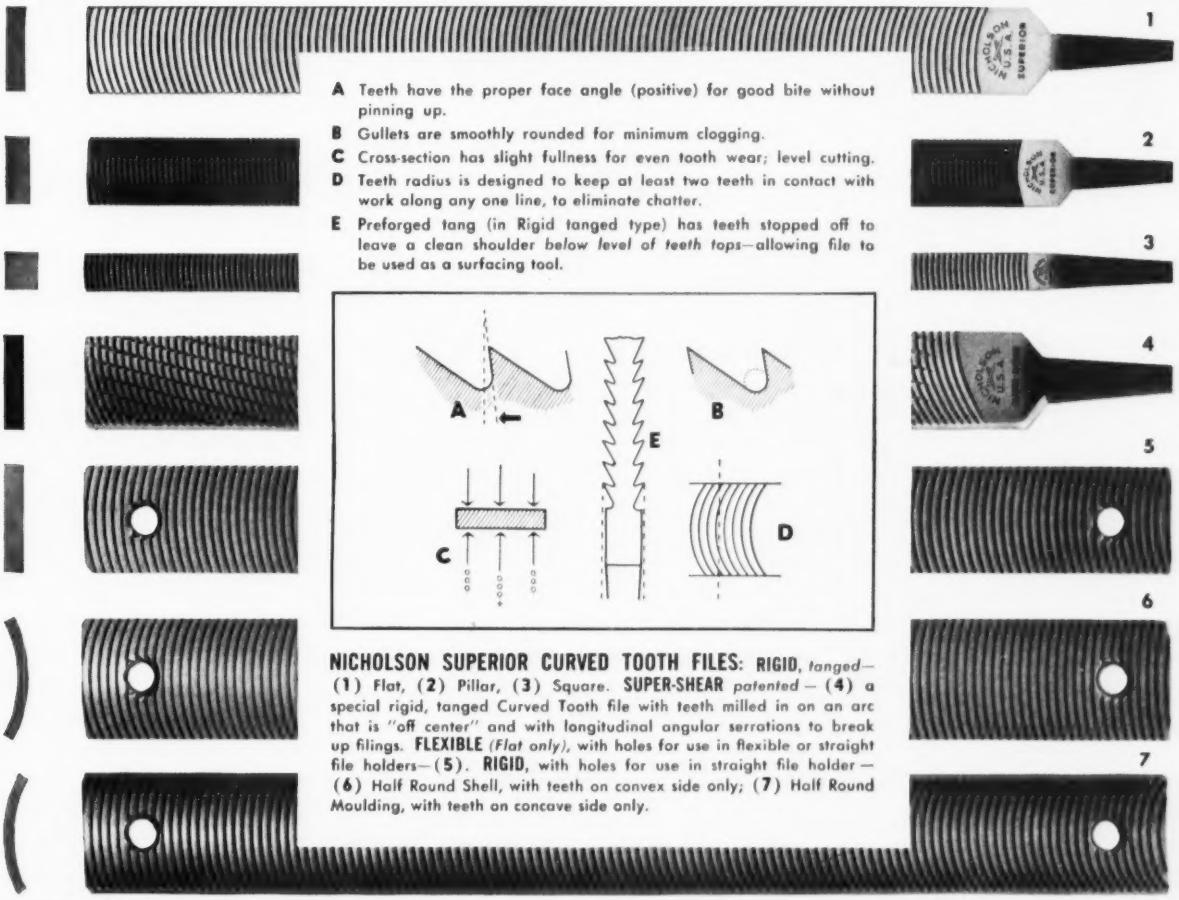
(*Continued on page* 296)

For more information on products advertised, use Inquiry Card, page 243

NICHOLSON SUPERIOR

Milled Curved Tooth Files

have these technical distinctions:



A Teeth have the proper face angle (positive) for good bite without pinning up.

B Gullets are smoothly rounded for minimum clogging.

C Cross-section has slight fullness for even tooth wear; level cutting.

D Teeth radius is designed to keep at least two teeth in contact with work along any one line, to eliminate chatter.

E Preforged tang (in Rigid tanged type) has teeth stopped off to leave a clean shoulder *below level of teeth tops*—allowing file to be used as a surfacing tool.

NICHOLSON SUPERIOR CURVED TOOTH FILES: **RIGID**, *tanged*—(**1**) Flat, (**2**) Pillar, (**3**) Square. **SUPER-SHEAR** *patented*—(**4**) a special rigid, tanged Curved Tooth file with teeth milled in on an arc that is "off center" and with longitudinal angular serrations to break up filings. **FLEXIBLE** *(Flat only)*, with holes for use in flexible or straight file holders—(**5**). **RIGID**, with holes for use in straight file holder—(**6**) Half Round Shell, with teeth on convex side only; (**7**) Half Round Moulding, with teeth on concave side only.

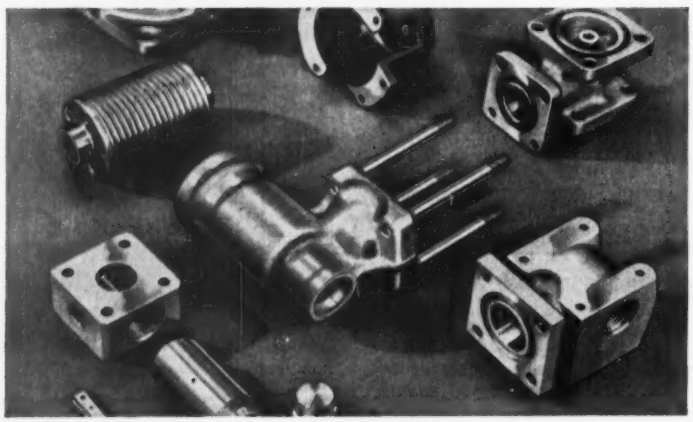
SUPERIOR in both name and fact is the confident claim made for these precision-milled Curved Tooth files. Note, above, the seemingly little things which jointly constitute a BIG thing in support of that claim. They are some of the visible evidences of matchlessly high quality and efficiency. But what you don't see are the thought, processes and care that go into their manufacture, such as:

Steels are studied, specified, analyzed for best tooth-cutting qualities and longest serviceable life. . . . Designs, embodying exclusive Nicholson features, are minutely worked out. . . . Teeth are milled in with specially designed machines, producing "razor-sharp" edges. . . . Hardening is conducted with meticulous care and uniformity. . . . Every step of manufacture is under rigid control and inspection. . . . There is no finer brand of Curved Tooth files under the sun.

BUY FROM YOUR INDUSTRIAL DISTRIBUTOR

NICHOLSON FILE CO. • 18 ACORN STREET • PROVIDENCE 1, RHODE ISLAND

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)



Industry depends upon the special skill of overhead linemen to keep the "hot" wires carrying power to turn the wheels. Many product manufacturers depend upon the special skills of Vinco production personnel to supply component parts. Because these parts are supplied at competitive costs and with a very minimum of scrap, they create an added profit for the customer.

All tools and gages used for mass producing component parts from ferrous or non-ferrous metals are designed and made to Vinco high standards in its tool and gage plant.

Let Vinco specialists prove that they are your best bet!

Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

Gear Pumps • Master Gears • Commercial Gears
B-1 Formed Wheel Dressers • Spline Gages
Optical Master Inspection Dividing Heads
Camshaft Comparators • Involute Checkers
Precisiondex • Gear Rolling Inspection Fixtures (R)

TRADEMARK OF DEPENDABILITY

VINCO

MILLIONTHS OF AN INCH FOR SALE

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Thor Power Tool Co., Aurora, Ill.

CHUCKING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

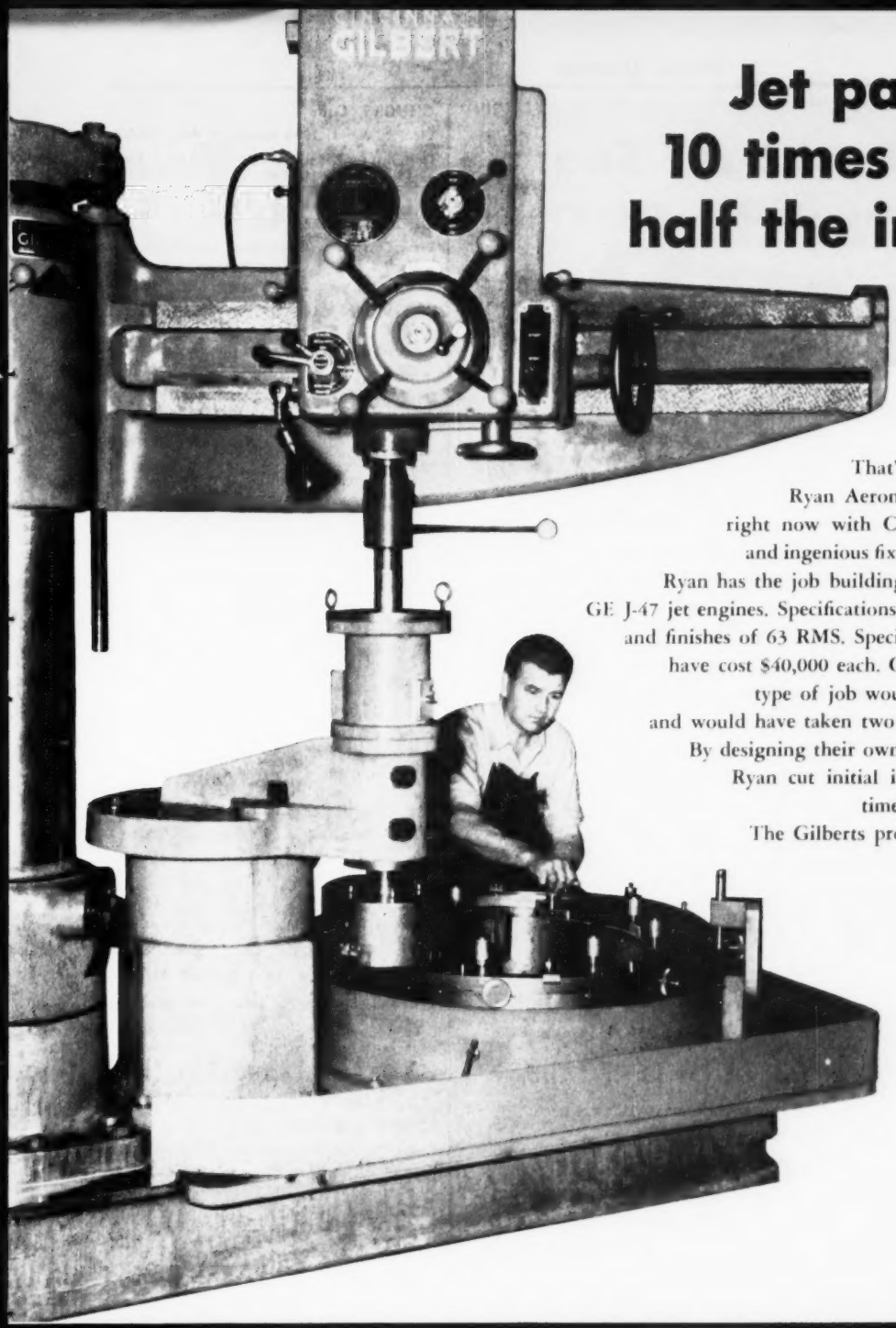
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(*Continued on page* 298)

For more information on products advertised, use Inquiry Card, page 243



Jet parts drilled 10 times faster for half the investment

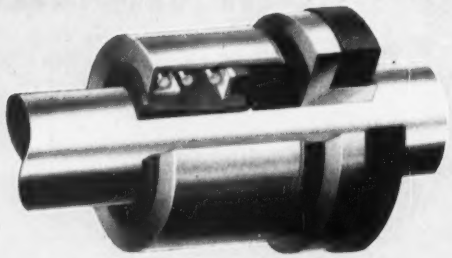
That's quite a story. But it's true. Ryan Aeronautical engineers are doing it right now with Cincinnati Gilbert radial drills and ingenious fixtures they designed themselves. Ryan has the job building stainless steel aft frames for GE J-47 jet engines. Specifications demanded tolerances of .005" and finishes of 63 RMS. Specially-designed machines would have cost $40,000 each. Conventional machines for this type of job would have cost equally as much, and would have taken two days to complete each frame. By designing their own fixtures to attach to Gilberts, Ryan cut initial investment in half, machining time from two days to *two hours.* The Gilberts provide the rigidity, power, and responsive controls so vital to precision jobs.

Clean design and rugged construction make Gilberts pay high returns on your investment. Quick response to controls, with minimum effort, plus positive "no-drift" clamping, help Gilbert operators get more work done accurately and faster. 9" and 11" columns. Thirty-day delivery. Ask your Gilbert representative to demonstrate why "those who buy Gilbert buy Gilbert again," or write for Bulletin 349.

GILBERT

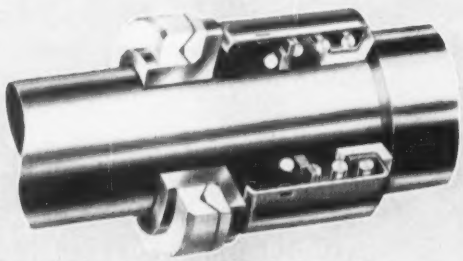
THE CINCINNATI GILBERT MACHINE TOOL COMPANY • 3366 BEEKMAN STREET, CINCINNATI 23, OHIO

Garlock "Package" Seals
FOR ROTATING PUMP SHAFTS



Type BB-21A—Garlock Package Seal of standard construction with brass shell, brass washer, and Buna-N bellows.

	TYPE BB-21A	TYPE AA-21A
Liquids	For water, oils, alcohol, solvents (except aromatic, chlorinated and ketone types) and other liquids (except strong acids).	For very strong acids, oils, solvents (including aromatic, chlorinated and ketone types) and all other liquids.
Equipment	Rotating shafts of centrifugal pumps, process pumps, chemical pumps, agitators and similar applications.	
Sizes	For shafts from ⅜" to 3" diameters.	
Temperatures	With Buna-N bellows up to 212°; with silicone bellows up to 450° F.	Up to 450° F.
Pressures	Up to 150 p.s.i.	Up to 150 p.s.i.



Type AA-21A—Garlock Package Seal with hat-shaped "Teflon" drive ring, brass or 316 stainless steel shell and washer, "Teflon" 'O' ring, and "Teflon" two-piece vibration ring.

✓ CHECK THESE IMPORTANT FEATURES

- ☐ Occupy very small space
- ☐ Completely assembled—ready to install
- ☐ Proven performance at low cost
- ☐ Both types are dimensionally interchangeable

In both of these Package Seals, a leakless seal is provided by a positive contact between carefully lapped metal-to-carbon mating surfaces. All metal parts in both types are available in plated-brass, Ni-Resist, stainless steel with malcomized face, Garlock "B" iron, and others.

For complete details, ask your Garlock representative or write us about your sealing problems.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.
Branch Offices in Most Principal Cities

GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton, E., & Son Co., Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.

CHUCKS, Lathes, Etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Horton, E., & Son Co., Windsor Locks, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CLAMPING APPLIANCES FOR MACHINE TOOLS

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLAMPS

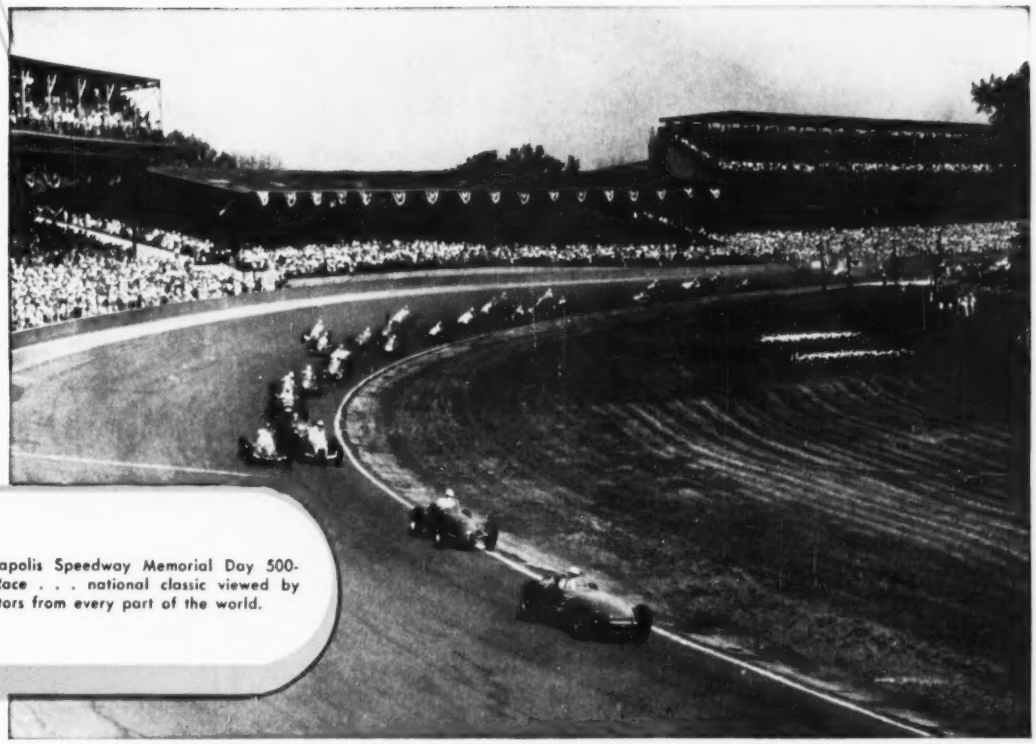
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.

(*Continued on page* 300)

For more information on products advertised, use Inquiry Card, page 243

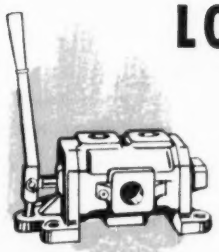
LOGAN . . . a national participant in major fluid power advancements

SINCE 1916



Indianapolis Speedway Memorial Day 500-Mile Race . . . national classic viewed by spectators from every part of the world.

LOGAN HYDRAULIC CONTROL VALVES

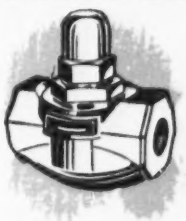


Illustrated, Model 4095—4-way, 2-position valve for directing pressure alternately to ends of double-acting hydraulic cylinder.

A broad range of types and sizes to most effectively meet any requirement—Design Engineers, Machine Operators, Maintenance Men appreciate these Logan advantages

- LONG-LIFE CONSTRUCTION
- EASY TO SERVICE
- INFREQUENT MAINTENANCE
- EASE OF INSTALLATION
- EFFORTLESS OPERATION
- UNRESTRICTED PORTING

Let Logan Engineers help you design your Air and Hydraulic Circuits



Illustrated, Model 8015 adjustable speed control valve. Install between operating valve and one end of cylinder to meter flow of oil in one direction with free flow on return.

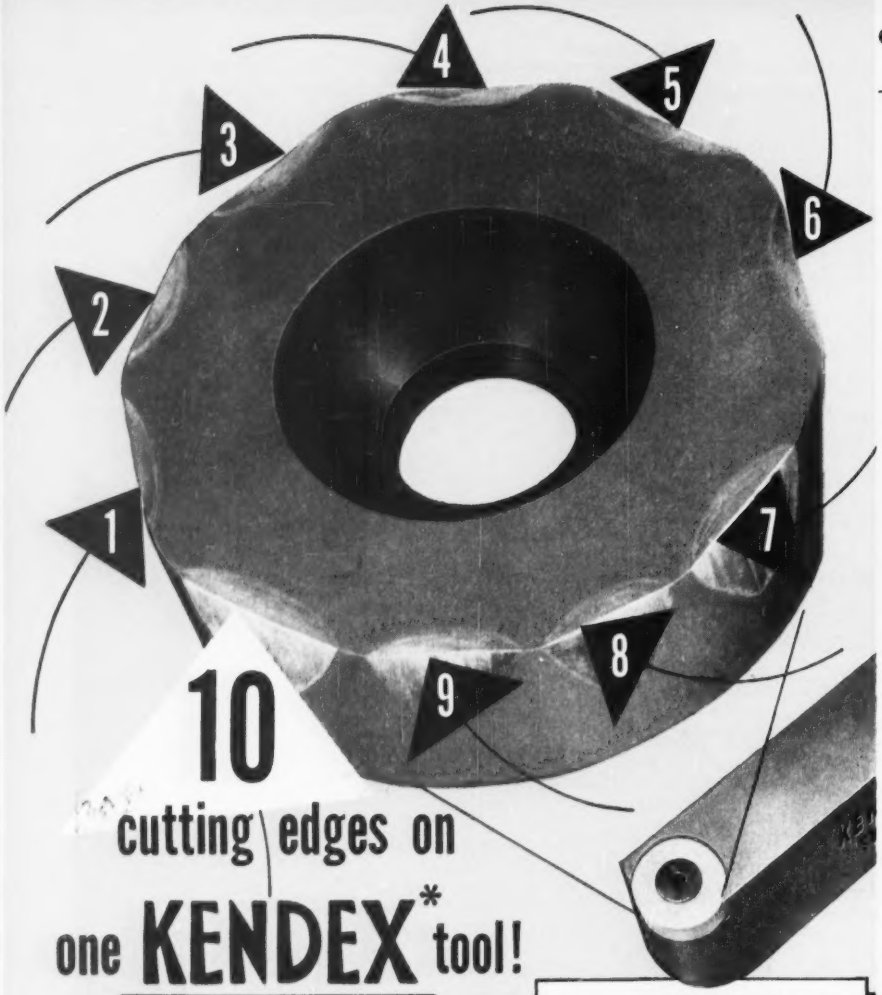
LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 · AIR CHUCKS, Cat. 70-1 · AIR CYLINDERS, Cat. 100-1 · AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 · COLLET GRIP TUBE FITTINGS, Cat. 200-5 · HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 · HYDRAULIC POWER UNITS, Cat. 200-1 · SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME — Logan — AIR AND HYDRAULIC EQUIPMENT — EFFORT-MOTION

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.



10 cutting edges on one KENDEX* tool!

No tool grinding expense and *minimum* machine down time for tool changing—these are the advantages you obtain from multiple-edge Kendex "throw-away" insert tools. For example:

A Kendex round insert, used to bore 2½" cast iron stators, machined 300 pieces before one cutting edge dulled. Then, without removing the shank from the boring bar, the "button" was revolved to a new cutting position, until 3,000 stators were machined with the insert's 10 cutting edges. Best previous performance, by a conventional brazed tool, was 400 stators per tool grind.

Kendex precision-ground buttons have Kennametal's high wear-resistance, for long life. Screw-mounted, they can be rotated in seconds to new cutting positions without removing or resetting the tool holder . . . a great time-saving feature. When all cutting edges are used, the insert is thrown away—replacement cost is slight compared to that of regrinding.

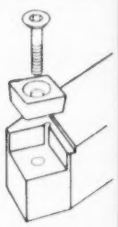
Only Kennametal makes Kendex "throw-away" inserts. Ask your nearest Kennametal tool representative to help you apply this cost-saving tooling to suitable operations in your plant. Kennametal Inc., Latrobe, Pa.

*Registered Trade-Marks

How KENDEX* Works

1 Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.

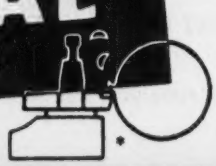
2 Kendex inserts are mounted to suitable tool holders with socket head screws.



3 When edge becomes dull, insert is turned to new cutting position. When all cutting edges have been used, insert is thrown away; no regrinding.

KENNAMETAL*

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY



SALES OFFICES IN PRINCIPAL CITIES

A-8

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co. Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co,. 23609 Hoover Rd, Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

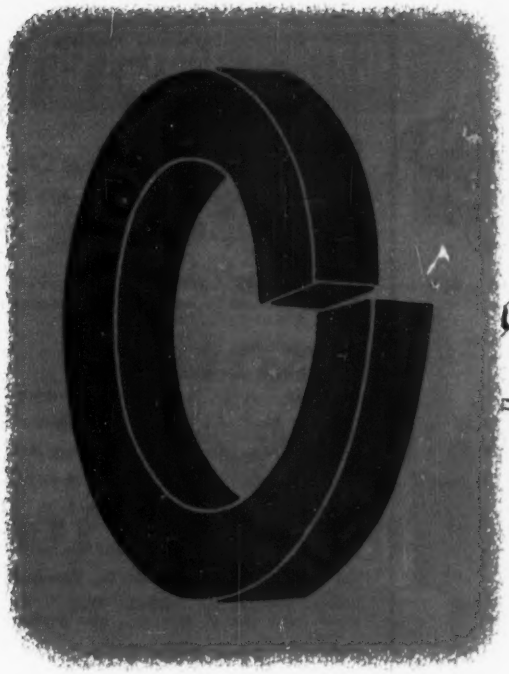
COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

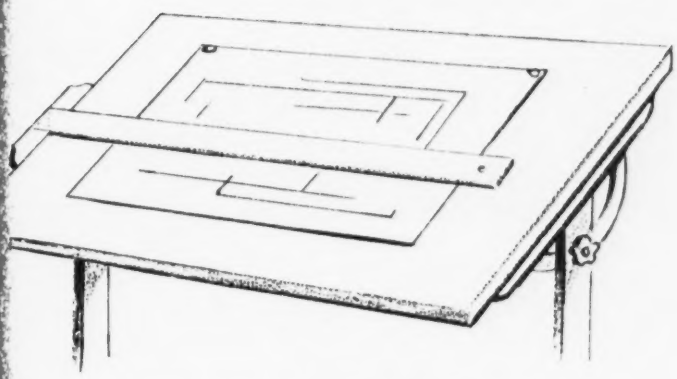
COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lapping)
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

(*Continued on page* 302)



tight assemblies



start with design

Reliance SPRING LOCK WASHERS

keep bolted assemblies tighter — at less cost!

Excellence of any manufactured product depends, in the final analysis, on how long and well it holds up on the job. Coming, brand new, off the drawing board and the production line, it will almost invariably radiate an appearance of beauty and efficiency. However, not until a portion of its life span has been spent doing the job for which it is designed, does the skill and ingenuity of the design engineer begin to be evident.

It is then that the "bugs" start to show up. Some are large and some small, but in any case, where bolted assemblies are used, it is a smart decision to specify Reliance Spring Lock Washers at the outset. Reason? Fundamentally because the designer as well as production men can rest assured that Reliance Spring Lock Washers keep bolted assemblies tighter. Their helical coil design assures maximum reactive tension through a wide reactive range. In spite of wear, vibration or bolt elongation, Reliance Spring Lock Washers keep threads seated and bolted assemblies tight. They've been proved and tested as trusted, efficient servants of the design-production team. Specify them on your next job—they won't let you down.

Send for Engineering folder W-50. It contains 36 pages of helpful Spring Lock Washer data.

RELIANCE DIVISION EATON MANUFACTURING COMPANY

OFFICE and PLANTS: 507 Charles Ave., S.E., MASSILLON, OHIO

SALES OFFICES: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

For more information on products advertised, use Inquiry Card, page 243

Four Standard Thread Rolling Attachments

REED RTD

For more than 100 sizes of machines

For more than 300 cross slide applications

Select the one you need...

Operating from the cross slides of automatic screw machines, each size of attachment is adjustable to accommodate an infinite range of work diameters within its capacity. Maximum thread rolling capacity within the tooling sector of over 100 sizes of single and multiple spindle automatic screw machines is possible through the selection of one of the four standard attachments. A large assortment of adapters are available that permit more than 300 cross slide applications.

Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS
Worcester, Massachusetts, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Philadelphia, Pittsburgh, St. Louis, Syracuse, Toronto

828

COMPOUNDS, Resin and Molding

Bakelite Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden, Ave., Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CONTROLS, THERMO

Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

COOLANT SEPARATORS

See Separators, Oil or Coolant.

COUNTERBORES

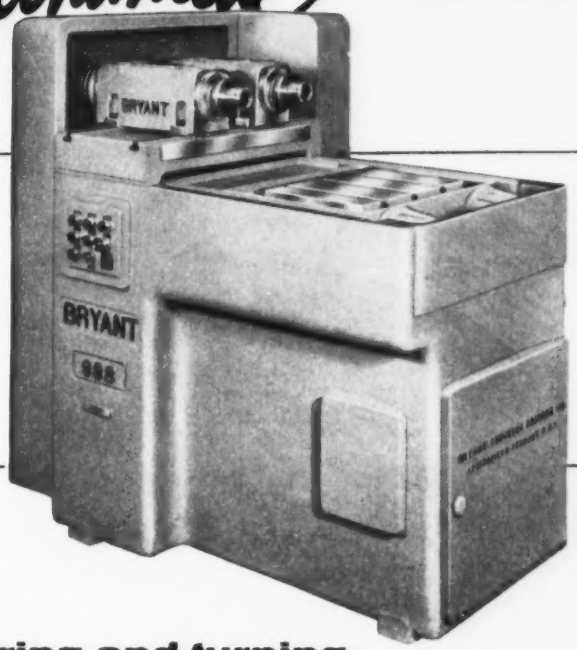
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

(*Continued on page* 304)

For more information on products advertised, use Inquiry Card, page 243

THE BRYANT 6" STROKE *all Mechanical* BORING MACHINE

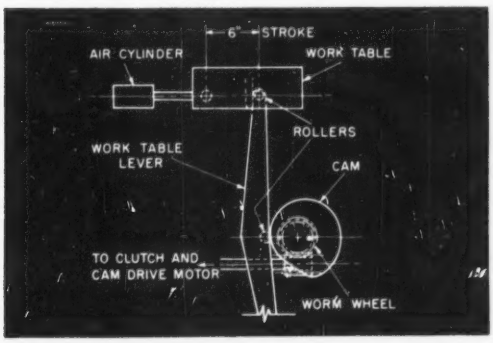
gives you



uniform accurate production

in precision boring, drilling, turning, facing, grooving and contour boring and turning

Higher Production Rates — The Bryant 998 is designed specifically to give rapid production with constant repetitive accuracy. The table is actuated by a simple cam and lever unit which provides positive control of the cycle at all times. This mechanical actuation of the table eliminates variation in the cycle due to temperature change. An air cylinder exerting uniform pressure directly on the table keeps the cam follower roll in steady contact with the cam, thus preventing backlash and jump. Cycle may be semi-automatic or automatic.



Finer Finishes — The Bryant 998 provides smooth, uniform table motion, an essential factor in generating a fine finish with a single point tool. The table moves on two 4" diameter solid steel slide bars firmly bolted to the bed. Each bar has two anti-friction preloaded ball bearings providing a metal-to-metal contact which eliminates slight shifting due to the presence of an oil film. The boring head spindles rotate in special super-precision ball bearings. These are spring-loaded, to ensure maintenance of spindle alignment during both boring and facing operations.

Less Down-Time — The Bryant 998 requires minimum maintenance. Motors, boring heads and slides are permanently grease sealed. This simple mechanical design is easily understood, and the units are accessible for maintenance.

Mail coupon for complete details!

BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VT.

Gentlemen: Please send me your Bulletin 998. M

Name.....

Title.....

Company.....

Street.....

City.....Zone....State.....

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

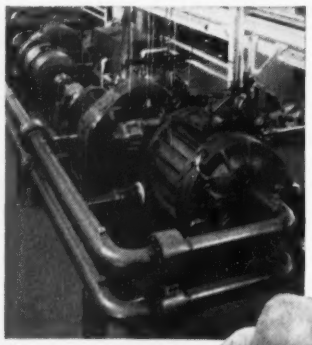
Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

For more information on products advertised, use Inquiry Card, page 243

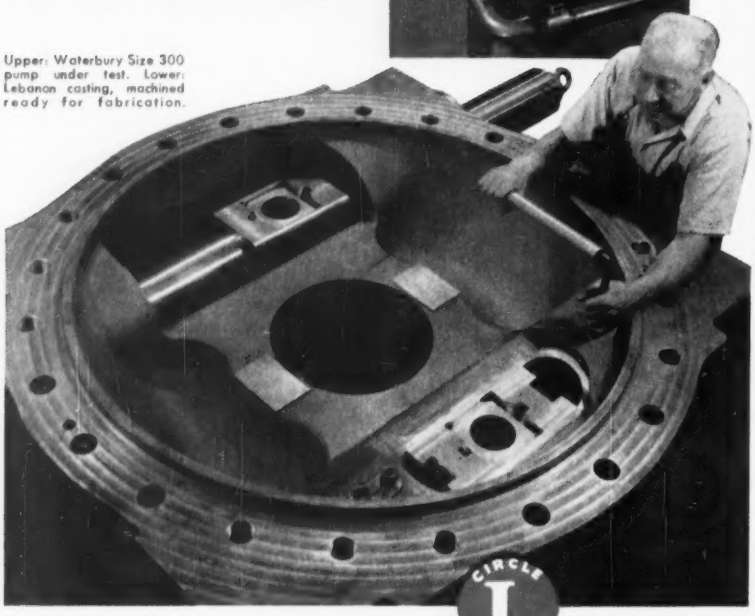
in the

World's Largest

oil hydraulic pumps



Upper: Waterbury Size 300 pump under test. Lower: Lebanon casting, machined ready for fabrication.



CIRCLE L

LEBANON STEEL Castings

are at work...

IN WATERBURY TOOL'S SIZE 300 PUMPS—largest oil hydraulic high-pressure pumps ever built—dependable Lebanon CIRCLE Ⓛ castings help confine the tremendous forces developed. These pumps are the working heart of the world's largest tube reducing machine being built by E. W. Bliss Company for Tube Reducing Corporation. On the tube reducer these pumps will move the equivalent of three fully loaded freight cars three feet forward and three feet backward—every two seconds! Each pump weighs 21½ tons, is capable of delivering 2300 gallons per minute at pressures up to 3000 p.s.i. and can transmit up to 4000 H.P.

Lebanon steel castings in the pumps for this extraordinary machine that cold rolls tubing up to 18" O.D., were engineered and built for enduring service.

●See—STEEL WITH A THOUSAND QUALITIES—37-min., 16 mm, semi-technical, full-color, sound film on the making of steel castings. For information write: Dept. X, Lebanon Steel Foundry.

LEBANON Castings

CARBON, SPECIAL ALLOY AND STAINLESS STEEL

CIRCLE L

LEBANON STEEL FOUNDRY LEBANON, PA.

Standard Tool Co., 3950 Chester Ave., Cleveland Ohio
Starrett, The L. S. Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg Co., Wickliffe, Ohio.
Morgan Engrg Co., Alliance, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

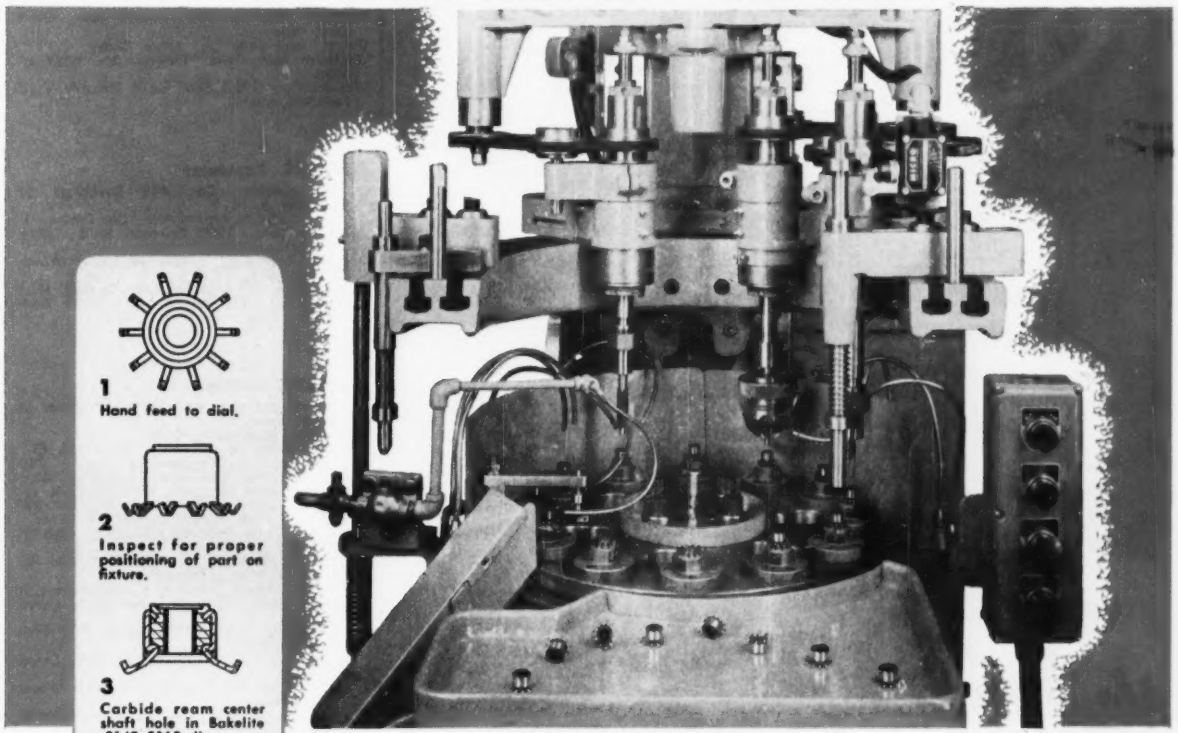
CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.

(*Continued on page* 306)

For more information on products advertised, use Inquiry Card, page 243

Bodine CASE HISTORY NO. 36



1
Hand feed to dial.
2
Inspect for proper positioning of part on fixture.
3
Carbide ream center shaft hole in Bakelite .3145-.3165 dia.
4
Carbide hollow mill on O.D. .691-.693 dia., using piloted hollow mill.
5
Carbide face Bakelite shoulder piloting in reamed hole.
6
Automatically eject.

PROCESSING A COMMUTATOR FOR A SMALL ELECTRIC MOTOR (Copper, molded in Bakelite)

FEATURING . . .

Carbide tools to (1) maintain high production speeds and longer tool life in extremely abrasive materials; (2) maintain close tolerances on machining operations.

PRODUCTION:

1070 pieces per hour at 85% efficiency. Machine used is the Bodine Model 41-20 tooled as a straight driller. This model can be tooled for drilling, tapping, milling, single or double screw inserting, and assembly operations . . . or any grouping desired. If you require high speed production at low costs, this is your machine.

"You Can't Meet Tomorrow's Competition With Yesterday's Machine Tools"

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

38D53

For more information on products advertised, use Inquiry Card, page 243

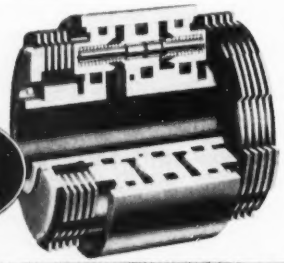
Giddings & Lewis Standardizes on . . .

New Twin Disc Oil-Actuated Multiple Plate Clutches!

For *more constant* torque . . . *longer* wear life . . . *higher* capacity for size . . . *elimination* of adjustment . . . and remote control at *less cost* . . . Giddings & Lewis have standardized on the new Twin Disc Oil-Actuated Multiple Plate Clutch for their "50 Series" Horizontal Boring, Drilling and Milling Machine. Giddings & Lewis—who worked closely with Twin Disc on pilot installations—will utilize two Model MOD (duplex) and four Model MOS (single) Clutches on their "50 Series."

Write to Twin Disc for information on how this all-new Oil-Actuated Multiple Plate Clutch might be applied to *your* machines.

Below, new Model MOD (duplex) Oil-Actuated Multiple Plate Clutch provides consistently longer wear life. Floating or pressure plate is ram of cylinder. As stack wears, ram travel increases automatically.



TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • SEATTLE • TULSA

Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429 Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread)
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwry., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

(*Continued on page* 308)

For more information on products advertised, use Inquiry Card, page 243

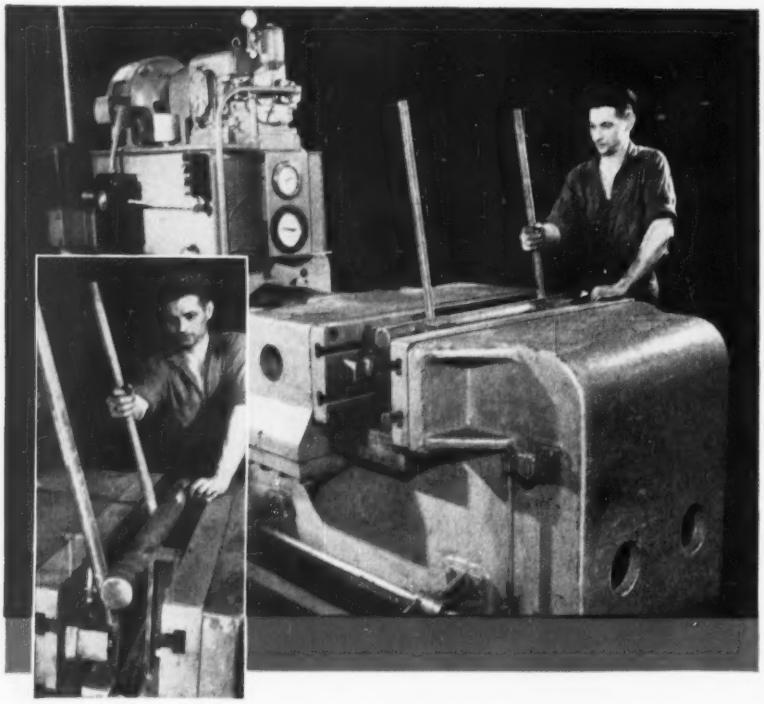
Card's 80 year record of concentration on one chief product shows up where it counts most — on your production line.

The CARD Quality

TAPS *by* CARD

Completely stocked offices at Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco and Seattle
See your local Card distributor for prompt deliveries and helpful service

W. CARD MANUFACTURING CO., MANSFIELD, MASS. • DIVISION OF UNION TWIST DRILL CO. **TAPS • DIES • SCREW PLATES**



Mercury Mfg. Co. does a better job twice as fast with a

FARQUHAR Hydraulic Press

Mercury Manufacturing Co., Chicago, Ill., producers of fork trucks, tractors and trailers, uses a 200-Ton Farquhar Horizontal Bulldozer press to make forgings and stampings and to form plates. In operation 8 hours a day, the press does most jobs twice as fast as the mechanical bulldozer used formerly, and better speed control produces better work.

In addition, many pieces of work that used to be farmed out are now done at Mercury—providing better production and quality control, and effecting additional savings of time.

In the operation shown above, high carbon brazed steel is bent quickly and accurately. In other operations, the press forms heads on bolts, legs for caster forms, and bends structural T frames.

Mercury reports very small maintenance costs, and sums up the company's satisfaction with, "It's the best!"

Farquhar Presses Cut Your Costs

Just one more example of cost-cutting Farquhar performance in heavy production! Farquhar Presses are built for the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

Farquhar engineers are ready to help solve whatever production problem you may have. Give them a call.

Send for Free Catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industry. Write to: A. B. FARQUHAR CO., *Hydraulic Press Dept.*, 1504 Duke St., York, Pa.

—A. B. FARQUHAR COMPANY Division of THE OLIVER CORPORATION—

Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).
Pines Engineering Co., Inc., Aurora, Ill.

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannafin Corp., 1101 S. Kilbourn Ave., Chicago.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

(*Continued on page* 310)

For more information on products advertised, use Inquiry Card, page 243

"We increased their production... with one suggestion"

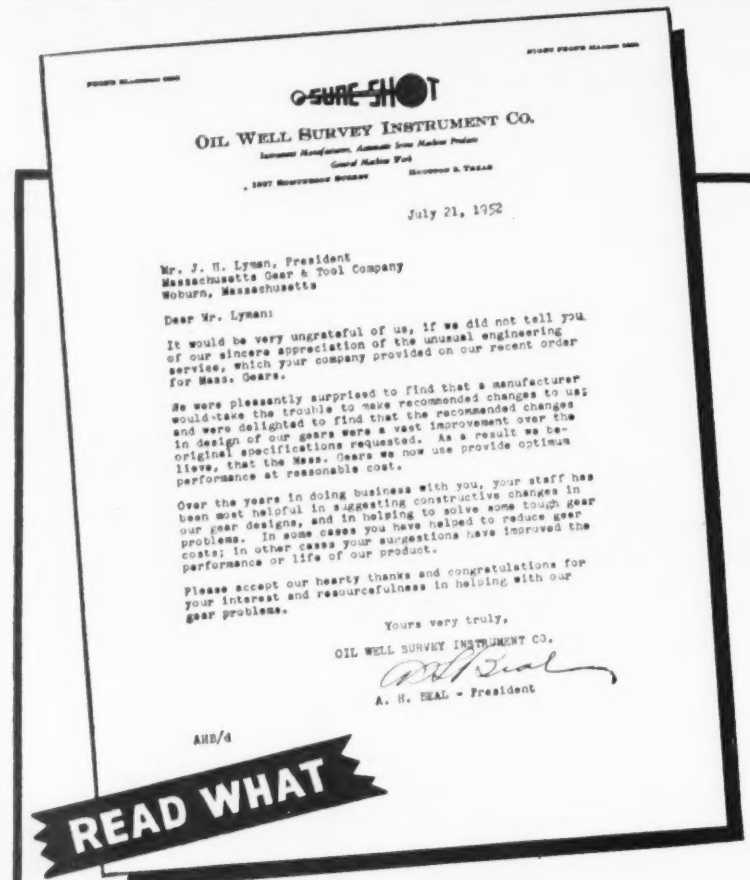
Rush government work recently brought a Philadelphia machine shop smack up against a common machining problem.

Sinclair Lubrication Engineer Harry Donovan reports, "This shop was running a series of exhaustive tests on the cutting oils of every major company and most of the specialty outfits. The problem was to find a coolant to serve as a *multi-purpose* cutting oil for varied types of metal from B1113 up to 440 stainless – suitable for all normal screw machine operations *including threading*. As production was on a 24-hour basis, *maximum speeds and feeds were desired*."

Mr. Donovan continues, "I suggested that the company try Sinclair HEAVY DUTY E.P. SOLUBLE OIL – explaining that it combines the lubricity and anti-weld qualities of a mineral cutting oil plus the cooling and rust-preventive qualities of a soluble oil. Results of a comparative test proved the choice was right. Sinclair HEAVY DUTY E.P. not only allowed maximum feeds and speeds but it also increased tool life and provided a better finish than any of the competitive products. This machine shop now uses Sinclair HEAVY DUTY E.P. SOLUBLE OIL exclusively."

SINCLAIR LUBRICANTS

Why not give a Sinclair Lubrication Engineer the chance to help solve *your* cutting oil problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.


SURE-SHOT
OIL WELL SURVEY INSTRUMENT CO.
July 21, 1952
Mr. J. H. Lyman, President
Massachusetts Gear & Tool Company
Woburn, Massachusetts
Dear Mr. Lyman:
It would be very ungrateful of us, if we did not tell you of our sincere appreciation of the unusual engineering service, which your company provided on our recent order for Mass. Gears.
We were pleasantly surprised to find that a manufacturer would take the trouble to make recommended changes and were delighted to find that the recommended changes in design of our gears were a vast improvement over the original specifications requested. As a result we believe, that the Mass. Gears we now use provide optimum performance at reasonable cost.
Over the years in doing business with you, your staff has been most helpful in suggesting constructive changes in our gear designs, and in helping to solve some tough gear problems. In some cases you have helped to reduce gear costs; in other cases your suggestions have improved the performance or life of our product.
Please accept our hearty thanks and congratulations for your interest and resourcefulness in helping with our gear problems.
Yours very truly,
OIL WELL SURVEY INSTRUMENT CO.
A. H. BEAL - President
AHB/d
READ WHAT

OIL WELL SURVEY INSTRUMENT CO.,
Instrument Manufacturers, Automatic Screw Machine Products and General Machine Work, has to say about
MASS GEAR'S *"unusual engineering service" and suggestions that "have improved the performance of our product"*

Ask for help on your gear problems. Send for illustrated literature.

Mass Gears
Massachusetts Gear & Tool Co.
Woburn, Mass.

CYLINDERS, Hydraulic

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordance Co., Irvine, Warren County, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc. Murray Hill, N. J.

DIE-CASTING

See Castings, Die.

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(Continued on page 312)

For more information on products advertised, use Inquiry Card, page 243

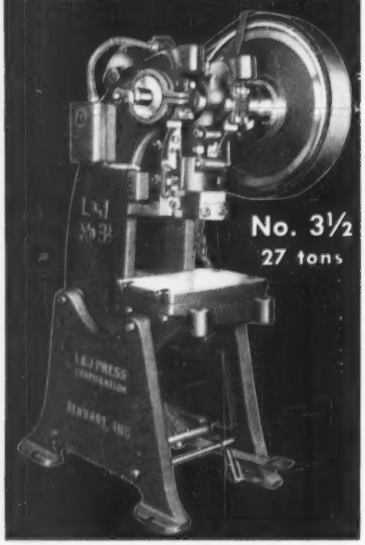
National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

NEW
L&J PRESS



A new ruggedly built press with the capacity, rigidity and accuracy for a wide variety of precision work. It has the time-tested L&J features that give you more value for your money through better and more efficient press work.

SPECIFICATIONS

Strokes per minute	120
Ram stroke, standard	2½"
max. stroke (to order)	4"
Ram overhang, center of ram to frame	6¾"
Die space, standard*	8¼"
special,* up to	12¼"
Bolster plate area	21½" x 13"
Opening through back	10"

*bed to ram, stroke down, adjustment up

Let our local distributor show you the benefits of putting L&J Presses to work for you. 17 O.B.I. models—flywheel and backgear types—6 to 80 ton capacities. All available with L&J—Fawick Air Clutches for high-speed production.

Write for literature

L&J PRESS CORPORATION
1631 STERLING AVENUE
ELKHART, INDIANA

DIEMAKERS' SUPPLIES
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES
Grob Bros., Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.
Precise Products Corp., 1328-30 Clark St., Racine, Mich.

DIE SETS, Standard
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp. 2895A W. Grand Blvd., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DIE-SINKING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS
See Stocks, Die.

DIES, Sheet Metal, Etc.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
John B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara M ch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

DIES, Threading
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.

(*Continued on page* 314)

NOW
VICTOR
"MOLYFLEX"®
HIGH SPEED STEEL BLADES
for
power
sawing

Here's the newest Victor Power Blade—a blade that is break-resistant for safety and economy. A blade that offers moly high speed performance at no premium cost.

Victor heat treating know how producing graduated hardness.

No matter what your metal-cutting problem, there's a VICTOR Blade for the job. Competitively priced.

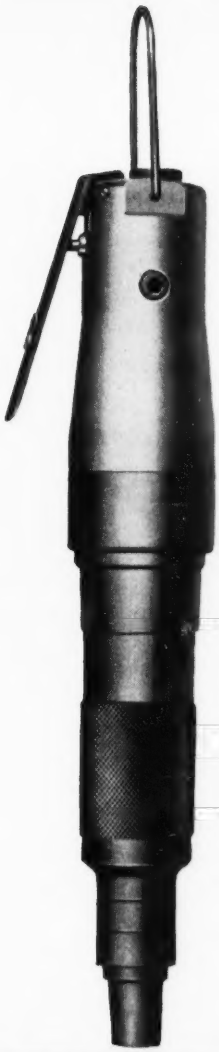
Call your nearby Industrial Distributor for VICTOR Blades—and for hundreds of the other items you need to keep production running.

Sold Only Through Recognized Distributors

3236

VICTOR
SAW WORKS, INC. • MIDDLETOWN, N.Y., U.S.A.
Makers of Hand and Power Hack Saw Blades; Frames; Metal & Wood Cutting Band Saw Blades.

For more information on products advertised, use Inquiry Card, page 243



Step up YOUR OUTPUT

Size OOBLC Screw Driver quickly drives #10-32 round head screws on a household ironer assembly.

A Size OOAMC Screw Driver makes quick work of driving #10 screws 1½" long to attach the spring mechanism on a rocking chair. The wood involved is alder; not predrilled.

Here a Size OOOBLC Screw Driver is used to assemble clocks. The job consists of driving Reed-Prince screws.

A Size OALC Screw Driver speeds the installation of the hood lock on an Automotive Assembly line.

with Ingersoll-Rand Air Powered Screw Drivers

46 sizes of air powered screw drivers are available with attachments to drive any type of threaded fastener.

Reversible and non-reversible models, also angle screw drivers.

More production in auto plants! . . . *More production* in an electric clock factory! . . . *More production* on a farm equipment assembly line! . . . *More production* of oil burners, metal products, home appliances, and products of every kind and description.

The credit? Ingersoll-Rand Air Powered Screw Drivers—with features that make it the world's best! The "Cushion" Clutch . . . amazing I-R Multi-Vane Air Motor . . . Torque Limiting Clutch . . . and many other design points enable operators to turn out more jobs with less effort.

TRY 'EM AND SEE! Phone or write your Ingersoll-Rand office today for details. No obligation.

Ingersoll-Rand 11 Broadway, New York 4, N. Y.

920-8

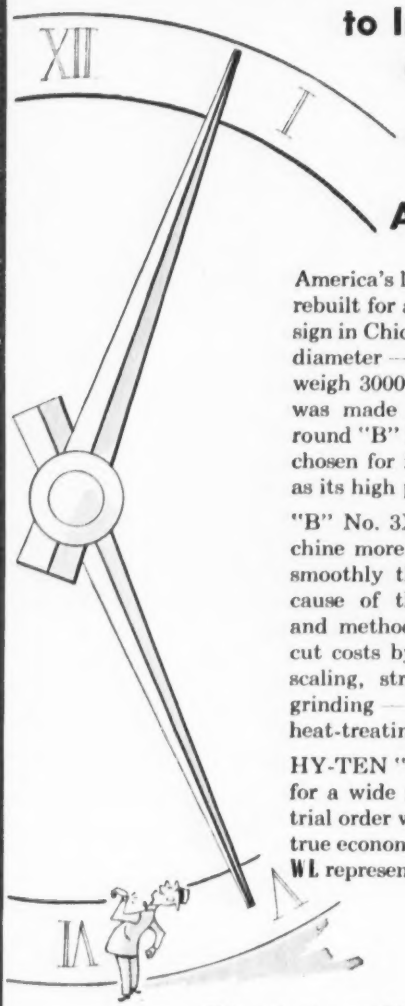
OVER ONE HUNDRED YEARS OF CONTINUOUS SERVICE. ROUNDS, SQUARES, FLATS, HEXAGONS, OCTAGONS

it's the right time

to Investigate the Qualities of

HY-TEN

ALLOY STEEL



America's largest clock was recently rebuilt for a spectacular illuminated sign in Chicago. It measures 50 ft. in diameter — hands and movement weigh 3000 lbs. The new driveshaft was made from 6 ft. of 3½-inch round "B" No. 3X heat-treated bar, chosen for its machinability as well as its high physical properties.

"B" No. 3X heat-treated bars machine more readily and finish more smoothly than standard alloys because of their particular analysis and method of manufacture. They cut costs by eliminating distortion, scaling, straightening — and often grinding — as well as the cost of heat-treating finished parts.

HY-TEN "B" No. 3X bars are used for a wide range of applications. A trial order will convince you of their true economy. Just call your nearest WL representative.

Write today for your FREE COPIES of Wheelock, Lovejoy Data Sheets, indicating your title and company identification. It contains complete technical information on grades, applications, physical properties, tests, heat treating, etc.

BILLETS AND FORGINGS FOR PRODUCTION, TOOL ROOM AND MAINTENANCE REQUIREMENTS

WHEELOCK, LOVEJOY & COMPANY, INC.

Warehouse Service

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SANDERSON-NEWBOULD, LTD., MONTREAL

HY-TEN and AISI

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Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Metalmaster Div., Clinton Machine Co., Clinton, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment.

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd.,
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Detroit 2, Mich.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

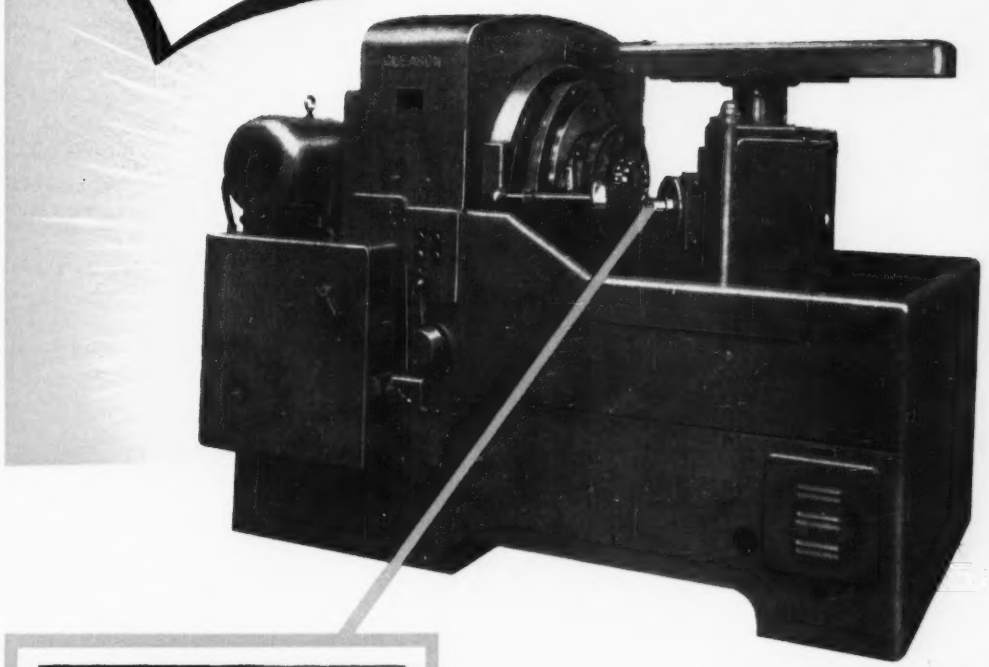
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

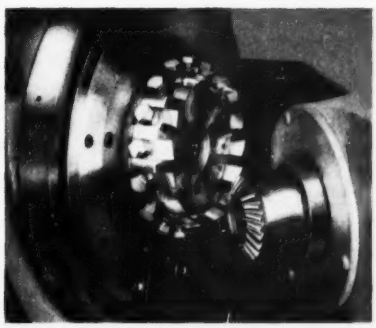
(*Continued on page* 316)

For more information on products advertised, use Inquiry Card, page 243

NEW

NO. 106 HYPOID GENERATOR





This tractor belt pulley drive gear, 25 teeth, 7 D P, 11/16" face, 8620 steel, is completed in one operation at 14.6 sec. per tooth, 5.8 min. floor-to-floor time.

. . . For cutting spiral bevel, ZEROL® bevel, and hypoid gears up to 4 D P, 8½" diameter, 1¼" face

This versatile machine is ideal for small quantities or mass production of gears in the above size range. Greatly increased production rates are assured, because of its improved features, including cam-actuated generating motion, and rigid new-type cutter spindle construction. Many gears which previously required separate roughing and finishing cuts can now be completed in one operation, with marked savings in floor-to-floor time and handling time per piece.

Send prints of your bevel gears for an analysis of the cost savings this new generator can offer you.

GLEASON

GLEASON WORKS

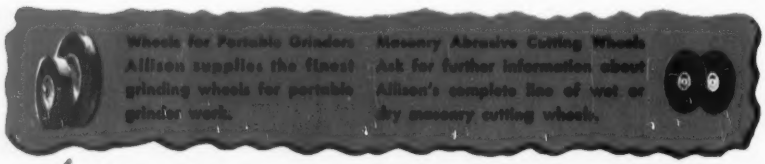
BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

cut your costs . . . where you cut your materials

Those who make decisions in industry really want to get a clear and unobstructed view of their cutting problems. When they do, they find great advantages in the abrasive method. Actual performance records prove that abrasive cutting with Allison job-tested wheels increases production and lowers costs.

Why not prove it to your own satisfaction? Simply get the facts and you will see why more production men turn to Allison Abrasive Cutting.


Wheels for Portable Grinders
Allison supplies the finest grinding wheels for portable grinder work.
Masonry Abrasive Cutting Wheels
Ask for further information about Allison's complete line of wet or dry masonry cutting wheels.

The *best* way to cut many materials . . . the *only* way to cut some.

Allison ABRASIVE CUTTING WHEELS

THE ALLISON CO., 265 ISLAND BROOK AVENUE, BRIDGEPORT, CONN.

4ALS3

DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

(*Continued on page* 318)

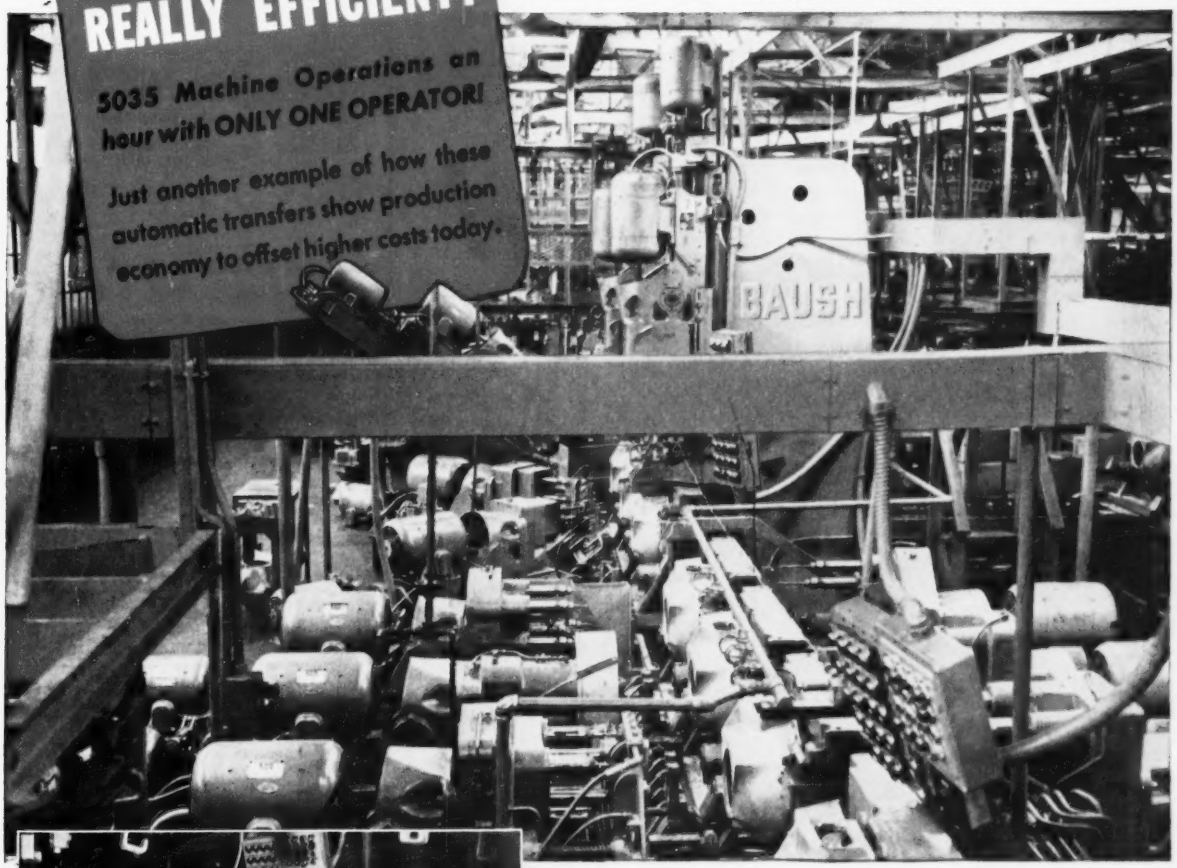
For more information on products advertised, use Inquiry Card, page 243

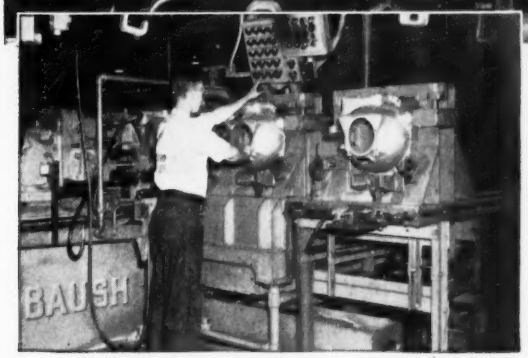
Baush Transfers are REALLY EFFICIENT!

5035 Machine Operations an hour with ONLY ONE OPERATOR!

Just another example of how these automatic transfers show production economy to offset higher costs today.

Looking down on Baush 9-Station Transfer Lineup.





Closeup of Torque Convertor Housings being loaded onto holding pallets at start of conveyor.

EQUIPMENT:

Transfer illustrated is a BAUSH 9-STATION LINEUP having 1 loading, 7 working, and one idle station. Transfer consists of 13 mechanical leadscrew units equipped with hydraulic locating and clamping features. Panel-type conveyor has 12 loading pallets to hold working part.

OPERATIONS:

Designed and built to J.I.C. Standards this transfer lineup performs 53 operations on Torque Convertor Housings.

All holes in clutch housings are drilled, rough and semi-finish bored, reamed and finish reamed, counter-sunk, chamfered and tapped, while transmission pilot hole is rough bored.

PRODUCTION:

Capacity is 95 Torque Convertor Housings per hour at 80% efficiency.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

GET MORE PARTS

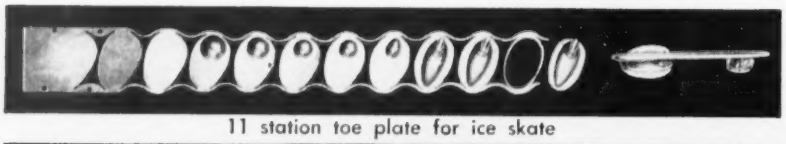
Per Day... Per Die... Per Dollar!

with . . .

Startling production results — and savings — are guaranteed by B. Jahn dies because each is engineered with ingenuity and craftsmanship that pays off throughout prolonged die life . . . designed for performance *and performance alone* . . . "production proved" to work — and keep on working — in the customer's equipment to his complete satisfaction.

PRODUCTION B. Jahn PROVED

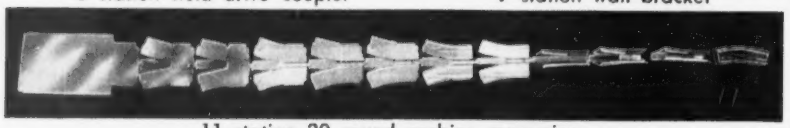
DIES



11 station toe plate for ice skate

6 station fluid drive coupler

7 station wall bracket



11 station 30 round carbine magazine

8 station parachute buckle

9 station car cigarette lighter part

ACTUAL CASE HISTORIES DEMONSTRATE HOW B. JAHN DIES BREAK PRODUCTION RECORDS . . . DELIVER MORE PARTS PER DAY, PER DIE, PER DOLLAR!

Send today for the fact-packed, picture story of "B. Jahn Production Proved Dies."

B. Jahn

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K. Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

(*Continued on page* 320)

For more information on products advertised, use Inquiry Card, page 243

ONE OF A SERIES

You Get Many Benefits by Specifying VICKERS® Hydraulics

Field Consultants on Oil Hydraulics

. . . 50 factory-trained application engineers

Vickers Application Engineers are a group of 50 specially trained and salaried men assigned to Vickers offices strategically located throughout the country. These men are selected for technical background and imagination. Each is given a very thorough training in Vickers plants before he goes to a field office. Training includes all phases of oil hydraulics, both theory and practice.

As a result, these men are uniquely qualified to help you in making hydraulics more useful to you and your customers. Their services take many forms . . . from complete circuit design to helping get the "bugs" out of a prototype machine.

They have at their command the wealth of Vickers Hydraulics resources. Contact the nearest Vickers Application Engineering Office whenever you have a problem where oil hydraulics may be helpful.

VICKERS
Incorporated
DIVISION OF THE SPERRY CORPORATION
1403 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND DETROIT • HOUSTON • LOS ANGELES (Metropolitan) NEW YORK (Metropolitan) • PHILADELPHIA PITTSBURGH • ROCHESTER • ROCKFORD • SEATTLE TULSA • WASHINGTON • WORCESTER

6358

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information on products advertised, use Inquiry Card, page 243

MODEL J
(Wet or Dry)
10″ x 18″ Capacity

Check its

✓ CAPACITY
✓ STRENGTH
✓ 3-Point Suspension
✓ Safety
✓ Centralized CONTROL
and You'll buy a
JOHNSON BAND SAW

MODEL B
5″ x 10″ Capacity
Light—Portable

WRITE FOR DETAILS

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

DRILLING MACHINES, Horiz. Duplex

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Ccsa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.

(*Continued on page* 322)

For more information on products advertised, use Inquiry Card, page 243

the best running mate your product can have–

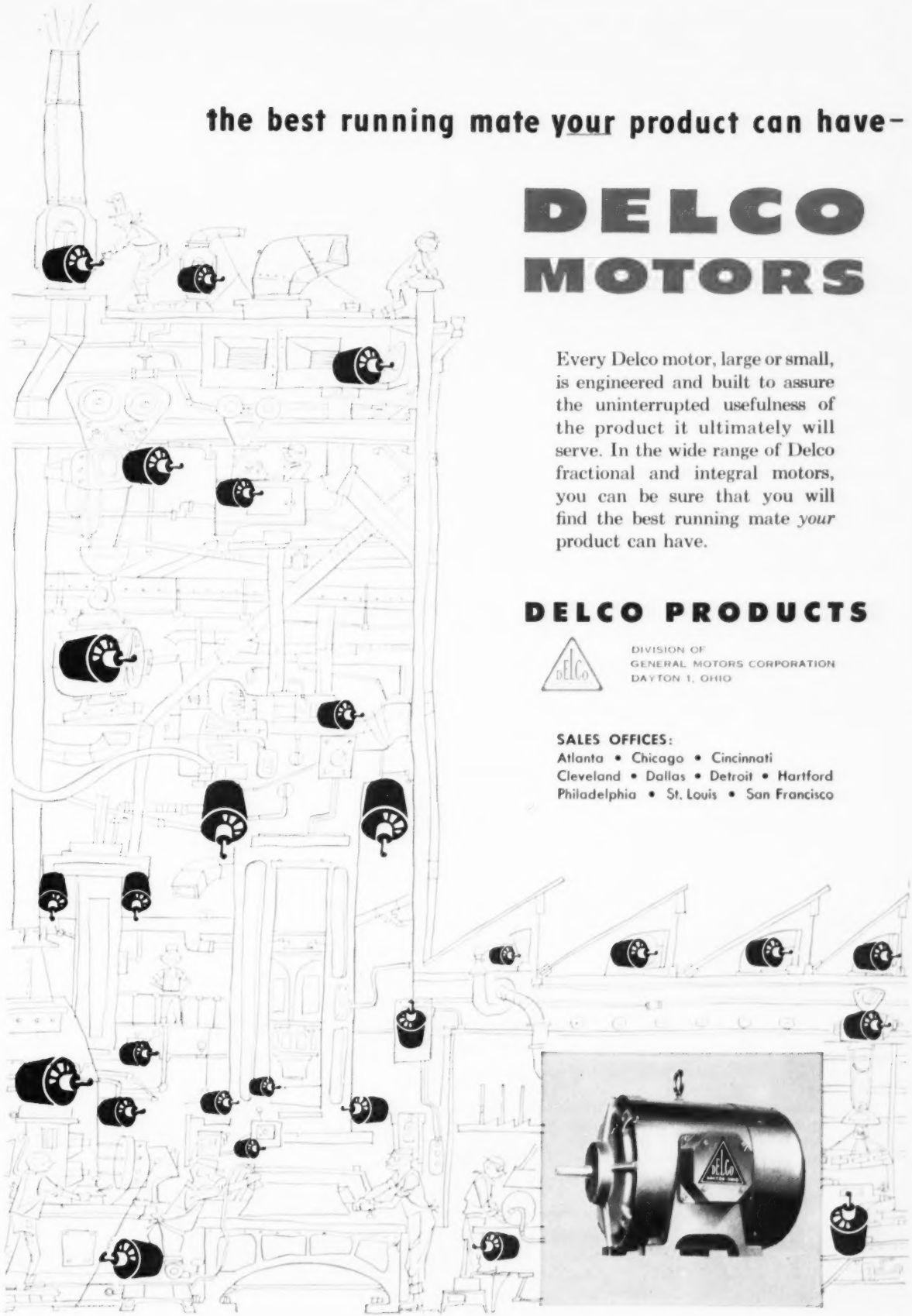
DELCO MOTORS

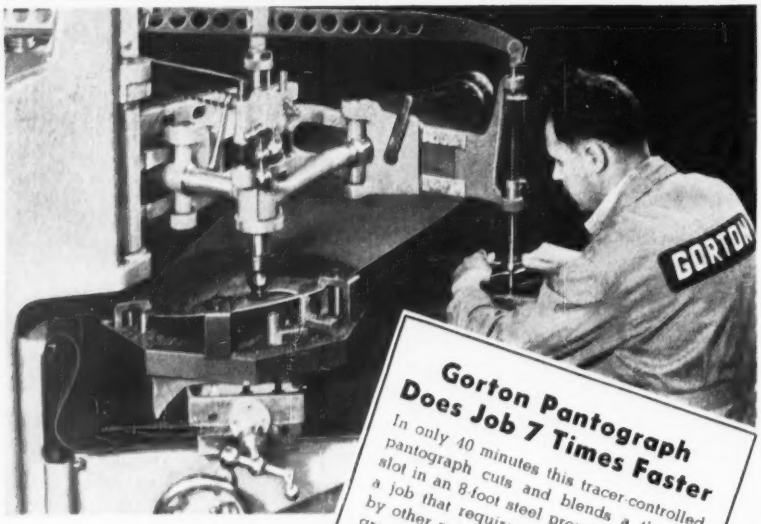
Every Delco motor, large or small, is engineered and built to assure the uninterrupted usefulness of the product it ultimately will serve. In the wide range of Delco fractional and integral motors, you can be sure that you will find the best running mate *your* product can have.

DELCO PRODUCTS

DIVISION OF
GENERAL MOTORS CORPORATION
DAYTON 1, OHIO

SALES OFFICES:
Atlanta • Chicago • Cincinnati
Cleveland • Dallas • Detroit • Hartford
Philadelphia • St. Louis • San Francisco





Gorton Pantograph Does Job 7 Times Faster

In only 40 minutes this tracer-controlled pantograph cuts and blends a thermal slot in an 8-foot steel propeller blade — a job that requires 5 hours 10 minutes by other methods. This is typical Pantograph performance — one of hundreds of examples.

Gorton Pantography Brings *Creative* Production to Your Plant

What's *your* problem in machining? Depend on Gorton Pantography to help you *create* a new production method if your problem falls into any of these categories:

OPERATIONS

Inside profiling	Counterboring
Outside profiling	Chamfering
Routing	Grooving
Die sinking	Graduating
Mold cutting	Engraving

MATERIALS
Ferrous metals
Non-ferrous metals
Plastics

SHAPES
Flat
Uniformly curved
Cylindrical
Square
Spherical
Irregular

Gorton Pantography works in two or three dimensions, in all directions on a horizontal plane, and vertically. It uses enlarged masters, templates or patterns — easily and inexpensively made. Normal operation takes advantage of the reduction ratio principle for increased accuracy in the work piece — an exclusive pantograph benefit.

Whether a dozen or a thousand pieces, each is identical in shape and tolerances to the first. Operation during cutting cycle is manual or automatic, and work piece size varies from the diameter of a dime to areas as large as ten feet.

Clip the coupon for your copies of the Gorton catalog and the helpful booklet, "Pantography."

GEORGE GORTON MACHINE CO.

Racine St., Racine, Wis., U.S.A.

Please send at once complete information about the Gorton line contained in Bulletin 1655-1302

Firm .....
Name .....
Title .....
Address .....
City, State .....

Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

Adcock & Shipley Ltd., Ash St., Leicester, England
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Upright

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.

(Continued on page 324)

For more information on products advertised, use Inquiry Card, page 243

Be WISE... Economize! with KEMPSMITH Standard Milling Attachments

KEMPSMITH ARBORS and accessories are available in all popular sizes and types. Adaptable to any make of milling machine with standardized spindle. Write for Arbor Bulletin.

Heed the warnings of the wise old owl . . . *never put a milling job on an expensive special machine if a standard miller can do the job just as well, or even better.* Utilize your standard equipment whenever possible. It cuts costs . . . adds to profits.

Kempsmith Standard Attachments broaden the scope of your milling machines. Backed by more than a half century of specialized experience building milling machines exclusively, these precision-built attachments result in (1) lower capital investment in machinery (2) saving in set-up time and (3) greater job versatility.

Write today for literature describing Kempsmith Standard Attachments, Arbors and Accessories. Also ask for copy of Bulletin No. 134 on the Kempsmith Improved Type "G" Milling Machine.

KEMPSMITH MACHINE COMPANY
1821 SOUTH 71ST STREET
MILWAUKEE 14, WISCONSIN, U.S.A.

KEMPSMITH

Precision Built Milling Machines Since 1888

A-5353-1P-C

Establish Highest Efficiency
In *Your* Toolroom
With Easy-to-Operate
OLIVER ACE
Universal Tool and Cutter Grinders

Get
- Precision
- Speed
- Economy

For dependability and ease of operation, the Oliver ACE is especially qualified in the grinding of tungsten-carbide and high speed milling cutters and tools. Extremely accurate, it has only one sliding part with ample bearing, efficiently protected from dust.

The Oliver Ace IS *Universal*—it handles a wider range of cutters than the ordinary cutter grinder—and all this with only two simple fixtures. Requiring no computation, the direct reading for clearances on the ACE increases the operator's efficiency in grinding the most difficult cutters (no stoop, no squat, no squint).

Nearly 40 years of designing and building lasting toolroom machinery stand behind the Oliver Ace. Easy to set up . . . it also effects economies in floor space and less outlay in dollars for this truly superior type machine. Let OLIVER show you the WAY to speedier, more economical precision tool and cutter grinding.

Direct Reading for Clearance
—Reduces Fatigue
—Eases Operators' Jobs

See our catalog in Sweet's Directory

Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing and carbide tipped circular saws.

2 MODELS: Standard and Heavy Duty (illustrated)
Write Today for Complete Data

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS
by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St. Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., N. Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

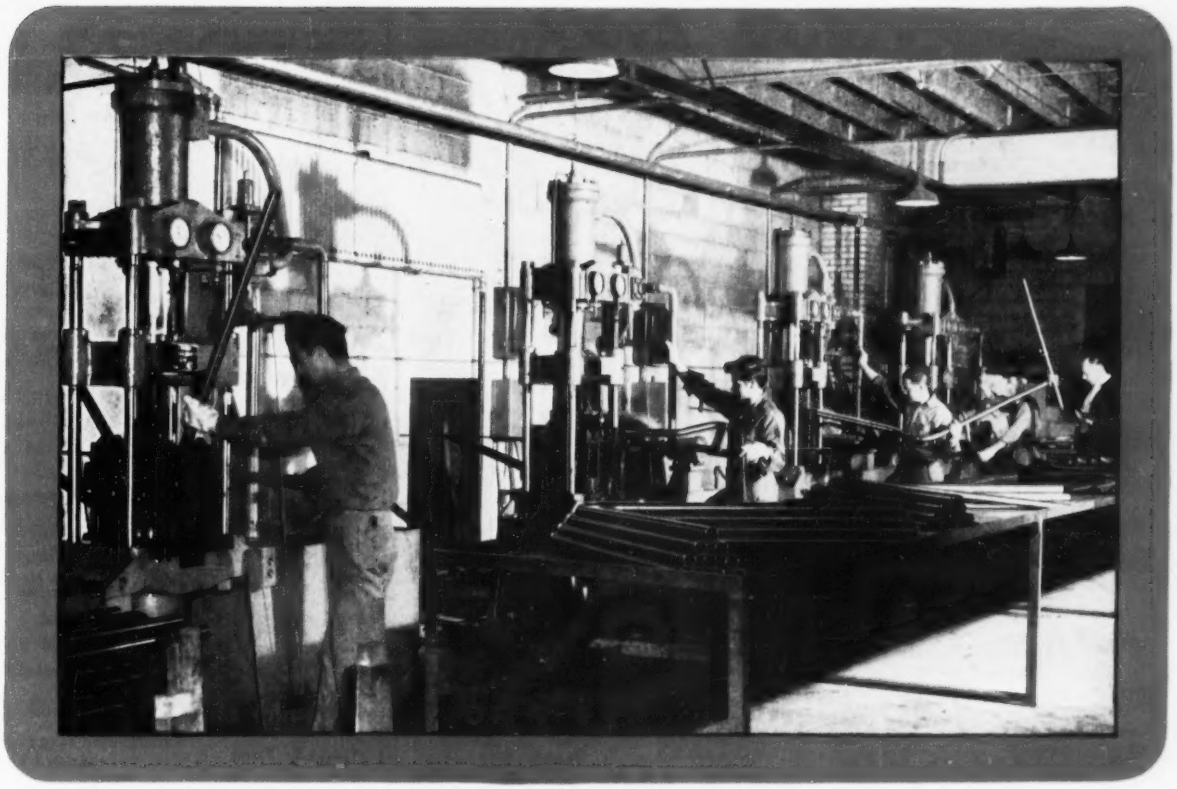
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Erickson Tool Co., 2309 Hamilton, Cleveland, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Wiley's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page 326*)

For more information on products advertised, use Inquiry Card, page 243



BENDING TUBING INTO TAILPIPES...

another job done better, faster

on ELMES Hydraulic Presses!

Four 20-ton hydraulic tube benders—one of many types of Elmes Presses built for special metalworking jobs—are shown above in operation at James Steel and Tube Co., Hazel Park, Michigan. Automobile tailpipes, each requiring seven bends, are produced at the rate of 2000 complete units per eight-hour shift.

These small but heavy-duty, high production Elmes Presses are designed especially for bending tubing into automotive exhaust and tailpipes. Their performance has been so outstanding—affording substantial savings in time, effort, maintenance and money—that they are now widely recognized as the logical "first choice" among presses used for this application.

Whether your metalworking press requirements call for special purpose designs, or can be met with standard production equipment, you'll find it always pays to "put your pressing problems up to Elmes." Many others have found it profitable . . . in terms of gaining *press performance at its best!* Ask Elmes engineers to assist you. Recommendations and cost estimates supplied promptly.

American Steel Foundries

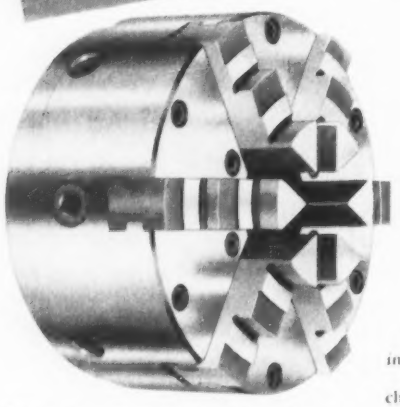
ELMES ENGINEERING DIVISION

1162 TENNESSEE AVENUE CINCINNATI 29, OHIO

DISTRIBUTORS IN PRINCIPAL INDUSTRIAL CENTERS —— ALSO MANUFACTURED IN CANADA

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

YOU SAVE Every Time You Use Buck

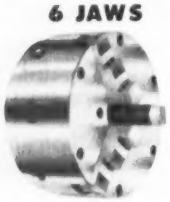


AJUST-TRU Pat. No. 2639157

CHUCKS

This is the only universal scroll chuck with .0005" precision. It is used on lathes, grinders, dividing heads, screw machines. Does most of work formerly requiring stub arbors, mandrels, special fixtures.

6 JAWS



OR 3 JAWS

3-jaw and 6-jaw models in 4", 5", 6", 7½", and 9" sizes. 2-jaw Aviation chucks, for holding odd shaped parts in 6", 7½, and 9".

Save machinists' time — lines up dead true in *one* minute, without shims . . .

Save operators' time — holds .0005" re-chucking precision on duplicate parts . . .

Save collet and step-collet costs — the AJUST-TRU does the work of hundreds of dollars worth of collets . . .

Save distortion on tubular work . . .

Save scratches on ground, polished, work . . .

Save time and expensive holding fixtures on many grinding operations . . .

Save chuck wear — it takes up wear in use . . .

More than ever today, you need the economies of Buck chucks. Send for latest catalog.

BUCK TOOL COMPANY

220 SCHIPPERS LANE • KALAMAZOO, MICH.

"I don't care if it is the fastest! I still can't drill your teeth with Columbia's CLARITE High Speed Steel."

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap — Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Besley-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS

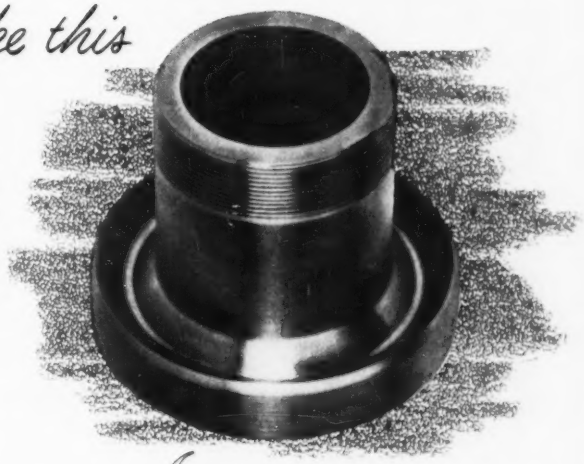
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rickford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois, Detroit, Mich.

(*Continued on page* 328)

For more information on products advertised, use Inquiry Card, page 243

automatic performance reduces costs

even on SHORT RUN *jobs like this*



A MOTOR MANUFACTURER who made this commutator sleeve, and similar components, in lots of 300 to 800 and in several sizes, said *"on a modern type, hand-operated turret lathe our net output varied from 2½ to 3 pieces per hour, depending upon conditions".*

Present output on his new Acme-Gridley Model M Single Spindle Automatic has more than doubled, as the job facts reveal. Much of this increase is due to Model M design features which avoid those so-called "conditions". Most important among these features is. . .

—fully automatic performance which guarantees a controlled cycle time and uniform precision—piece after piece

In other shops, these newest Acme-Gridley Single Spindle Bar Automatics, on hundreds of small and large lot jobs, are *2 to 10 times faster than the machines they replaced.* Ask for Catalog M-50A—better still, ask us to quote.

Other Model M time and cost reducing advantages are—

- Eight independently operated tool slides and three automatic spindle speed ranges selective to suit each cut, whether for use of carbide or high speed tools.
- Turret indexes in 1 second and its independent tool slides provide for overlapping operations such as several short end cuts while the heavy cuts are continued from the side slides.
- The Model M also features standard cams, interchangeable spindle speed and feed change gears, and wide open tooling zone—all quickly accessible. So the set up time for changing jobs to secure fully automatic performance on similar work does not exceed that of the hand operated lathe.

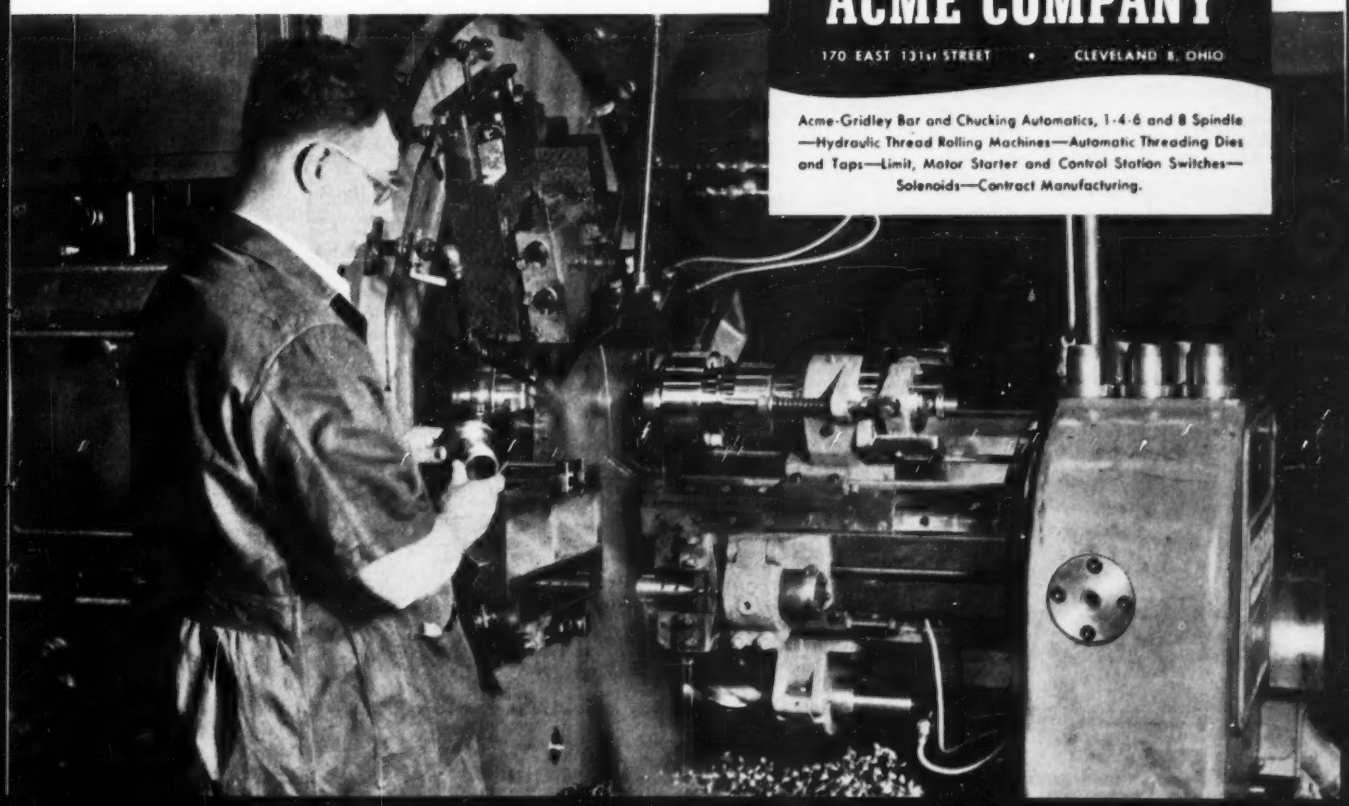
JOB FACTS:

Part: Commutator Sleeve
Size: 3⅜" dia. 2¾" long
Material: C-1030 Steel
Machine Time: on Acme-Gridley 3½" Model M Single Spindle Automatic—10½ minutes.
Operations: 11, including rough and finish trepan on O.D. of flange for smooth finish, reaming hole for close concentricity and threading with automatic Vers-o-tool to class 3 fit.
Former Time: on current model hand operated turret lathe—20 to 25 minutes.

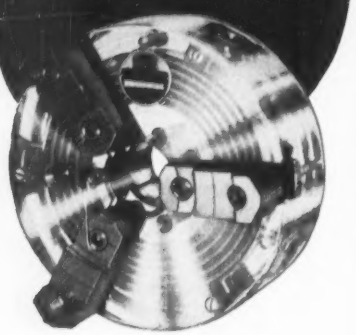
The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics, 1-4-6 and 8 Spindle—Hydraulic Thread Rolling Machines—Automatic Threading Dies and Taps—Limit, Motor Starter and Control Station Switches—Solenoids—Contract Manufacturing.



NOW SEE what HORTON CHUCK EXTRAS can do for you!



SEE the actual operation of a Horton Chuck with the new Plastic Demonstrators.

NOTICE the pilot hole construction of the independent chuck and the replaceable pinion bushings of the Scroll Universal Chuck — both Horton Exclusives.

ASK your Horton Distributor for a demonstration now. or write to . . .

HORTON CHUCK

Windsor Locks, Conn.

DUST COLLECTORS
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

EMERY WHEELS
See Grinding Wheels.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts. Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic
Federal Press Co., 600 Division and Big Four R. R. Elkhart, Ind.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
Atrax Co., Newington, Conn.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis, Chas. L., Co., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Thor Power Tool Co., Aurora, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob Bros., Grafton, Wis.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis 7, Ind.

FLEXIBLE COUPLINGS
See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT
Jarvis, Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGINGS, Hollow Bored
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

(*Continued on page* 330)

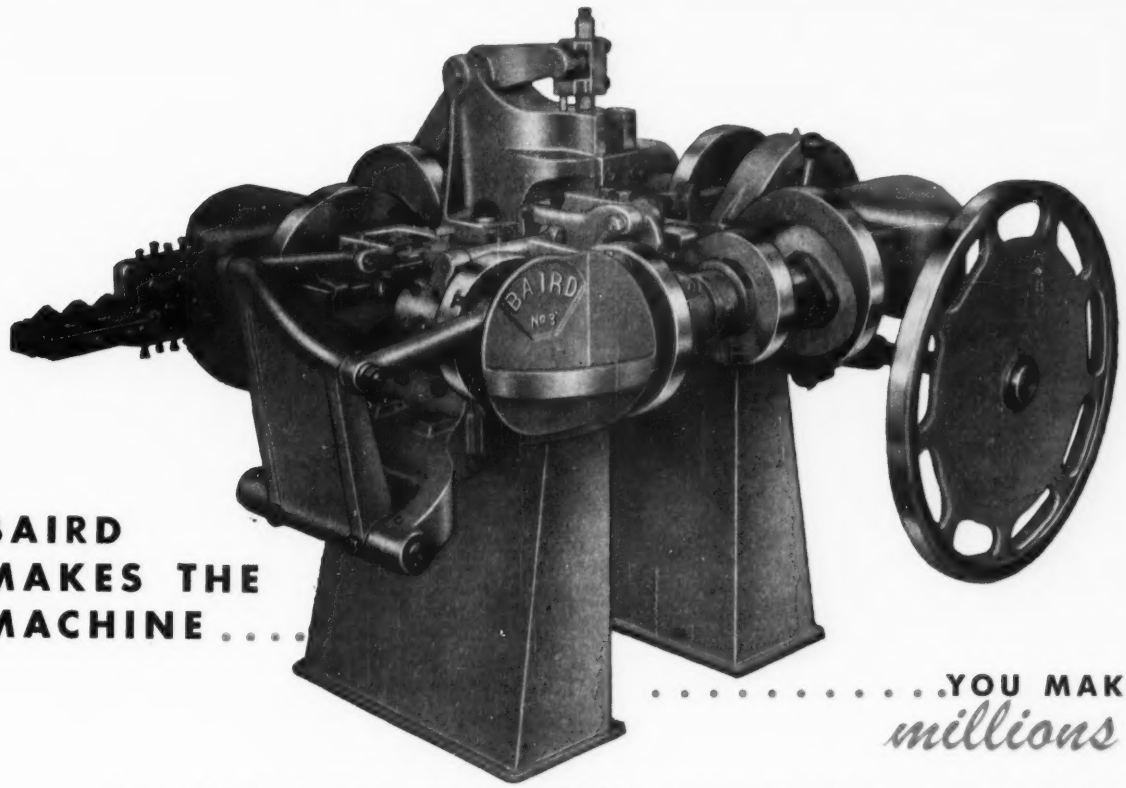
For more information on products advertised, use Inquiry Card, page 243

ASK

BAIRD

ABOUT IT!

HIGH PRODUCTION TOOLING



BAIRD MAKES THE MACHINE . . . .

. . . . . YOU MAKE *millions*

. . . OF ACCURATELY FORMED WIRE AND RIBBON METAL PARTS

The Baird automatic Four-Slide Machine produces an extremely wide variety of articles made of any commercial wire . . . round, half-round, square, or flat . . . at highest speeds. It takes coiled wire from a reel, straightens, feeds, and cuts off the required length . . . then forms and ejects the part produced. Eight sizes handle shorter wire lengths; three sizes take longer lengths to 32½".

By means of special attachments, the versatility of the machine is further extended to include the making of round wire and ribbon metal rings, secondary cut-offs, lettering, and other operations.

The detailed and complete story, with specifications, is told in our new Four-Slide Bulletin. If you require hundreds of thousands or millions of wire units to ½" dia., or flat ribbon metal products to 1½" wide . . . this is your profit-making machine. Send for bulletin.

3BA53

the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded

Mahon, R. H. Co., Detroit 34, Mich.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

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Alina Corp., 401 Broadway, New York 13, N. Y.
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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
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Millers Falls Co., Greenfield, Mass.
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(Continued on page 332)

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Plain Pointers on Projection

MOST optical textbooks mention the French physicist Augustin Jean Fresnel in connection with his work in helping to establish the wave theory of light. However, Fresnel also contributed greatly to the design of optics used for lighthouses. His work in this field, which forms the basis upon which lighthouse opticians still work, has led to the coupling of his name with a distinctive "flat" lens type.

At first glance this might seem removed from the field of optical gaging and the use of contour projectors throughout industry. The truth of the matter is, however, just the opposite. In designing the Kodak Contour Projector, our optical engineers have included a Fresnel lens directly behind the instrument's ground-glass screen.

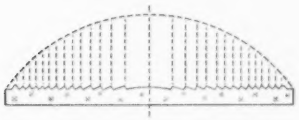

Fig. 1. Steps of the Fresnel lens duplicate the curvature of conventional condensers, making it possible to "collapse" a lens into a flat plane.

This flat plastic lens is illustrated schematically above (Fig. 1). In effect, a curved surface is collapsed into a series of minute steps which reduce the mass of the lens to a practical size. A conventional lens used for the same purpose, of diameter to equal the projector screen, would be more than 5" thick, heavy, and not inexpensive.

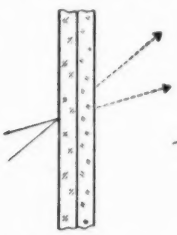

Fig. 2. Diffusing properties of ground-glass screen scatter oblique light away from viewer's eye.

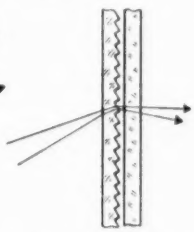

Fig. 3. Fresnel lens behind ground-glass screen directs oblique light towards viewer.

Use of the Fresnel lens in this manner serves a double purpose: 1) it effectively increases screen brilliance by directing the light on the screen directly at the operator's position; and 2) it provides even illumination over the entire screen area.

Because of this our projectors may be used under normal shop illumination without hoods or curtains—both of which sometimes tend to give a feeling of claustrophobia. In addition, the over-all screen brilliance makes possible easy reading of critical tolerances at any point on the projector screen. Together, these attributes tend to make your personnel more contented and efficient . . . help to make contour projection suited to mass inspection needs.

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The Kodak Contour Projector is particularly suitable for such routine production inspection. It requires no hoods, curtains, or darkened room (the column at the left tells you why). Operators work rapidly and accurately in comfort—require little training. And, simply by changing chart-gages and staging fixtures, all sorts of complex parts, large and small, can be inspected.

To find out more about the Kodak Contour Projector and how it can work for you, send for our 12-page booklet. Or, write for details on a sound movie, "Optical Gaging."

the KODAK CONTOUR PROJECTOR

91

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(*Continued on page* 334)

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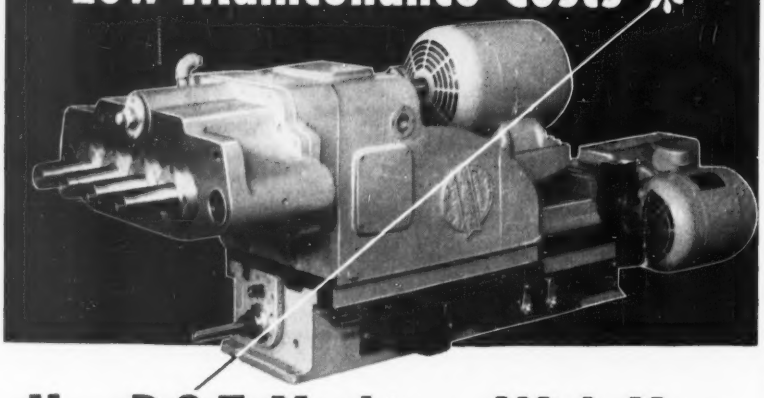

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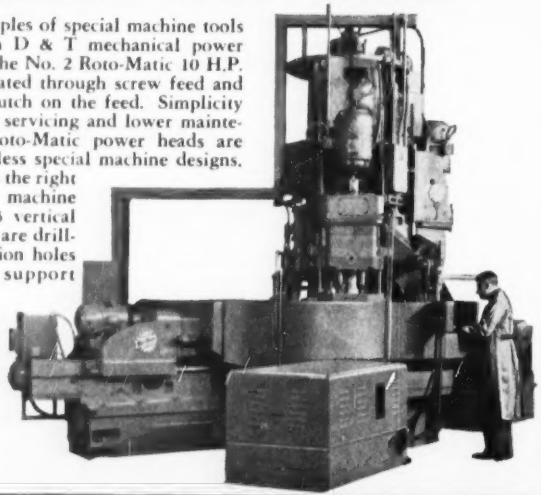

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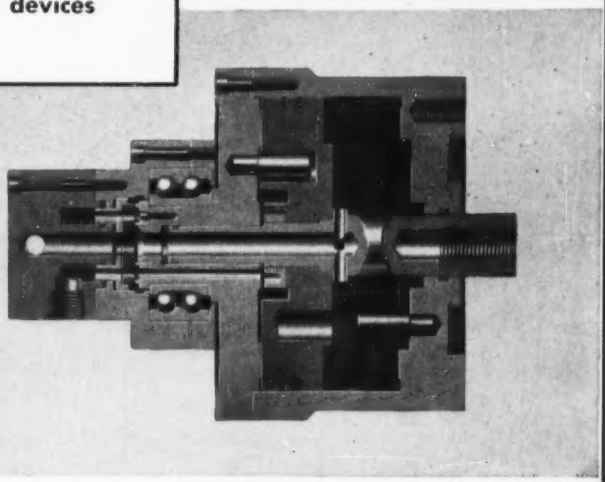

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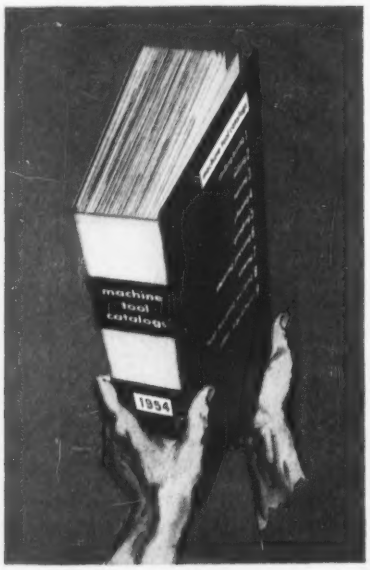

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(Continued on page 336)

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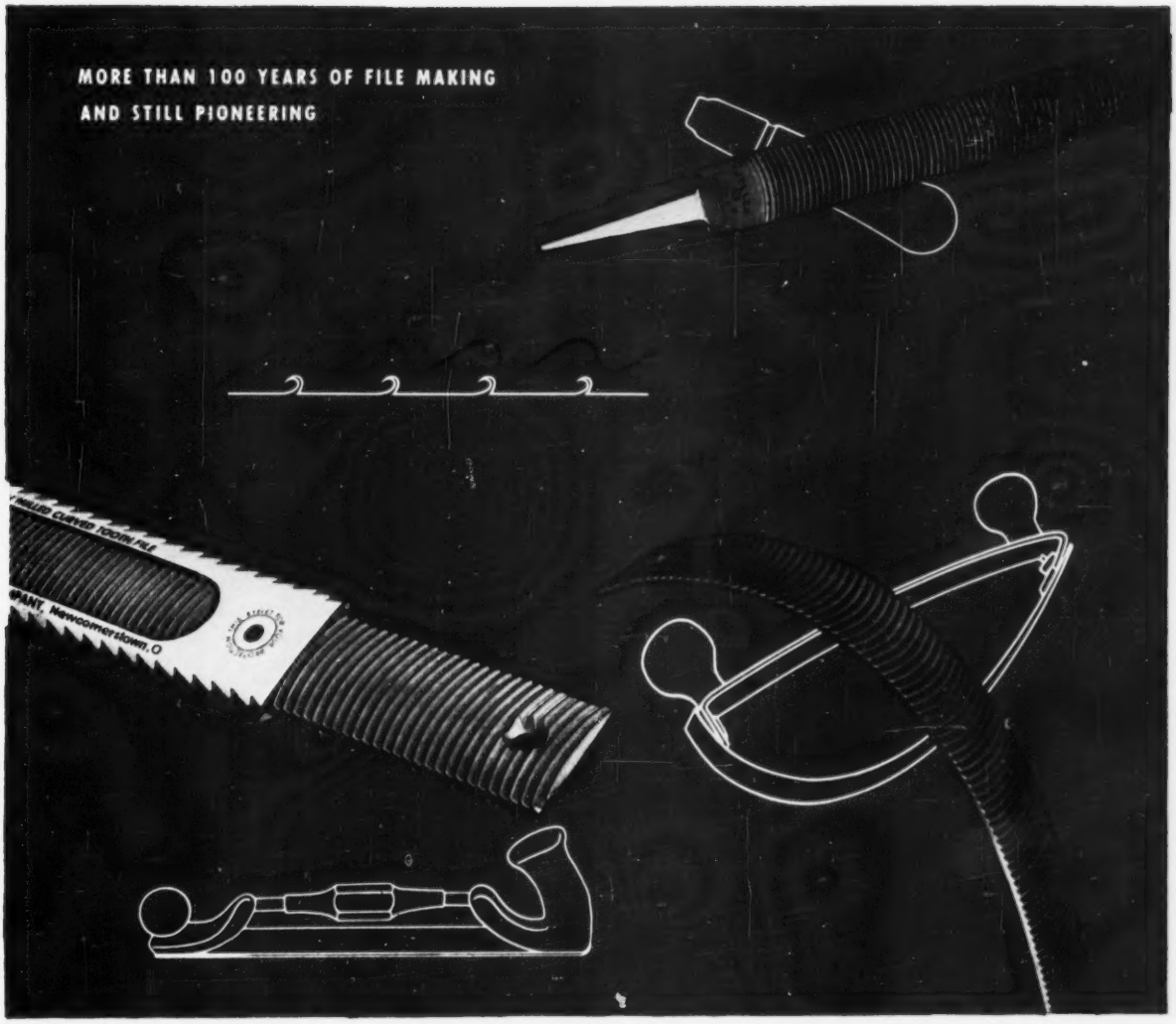

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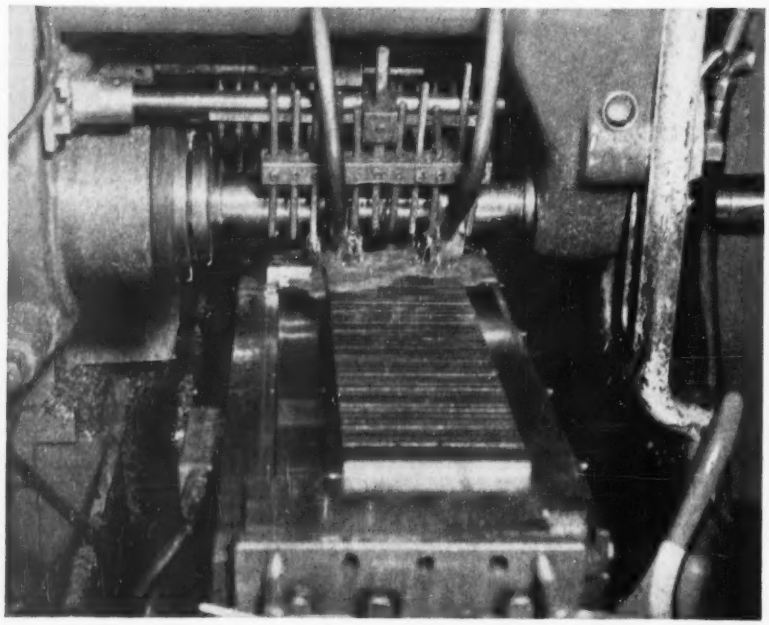
Franke Gear Works, Inc., 1924 W. Columbia Ave., Chicago 26, Ill.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia Pa.
Pittsburgh Gear Co., 2700 Smallman St., Pittsburgh, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

Walker Does It Again-



Scientifically established principles of magnetic chuck design—utilizing *balanced polarization* and (most important) *control* of magnetic motive force *away* from machine tool tables and spindles, form the basis of successful holding for milling operations. Walker Magnetic Chucks for milling reduce hand time, expedite production, extend cutter life, decrease costs.

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

In Canada—Upton Bradeen & James, Ltd.

GEARS, Rawhide and Non-Metallic

Amgears, Inc., 6633 W. 65th St., Chicago 38.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Pittsburgh Gear Co., 2700 Smallman St., Pittsburgh, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Centerless

Van Norman Co., Springfield, Mass.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N.Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Thor Power Tool Co., Aurora, Ill.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

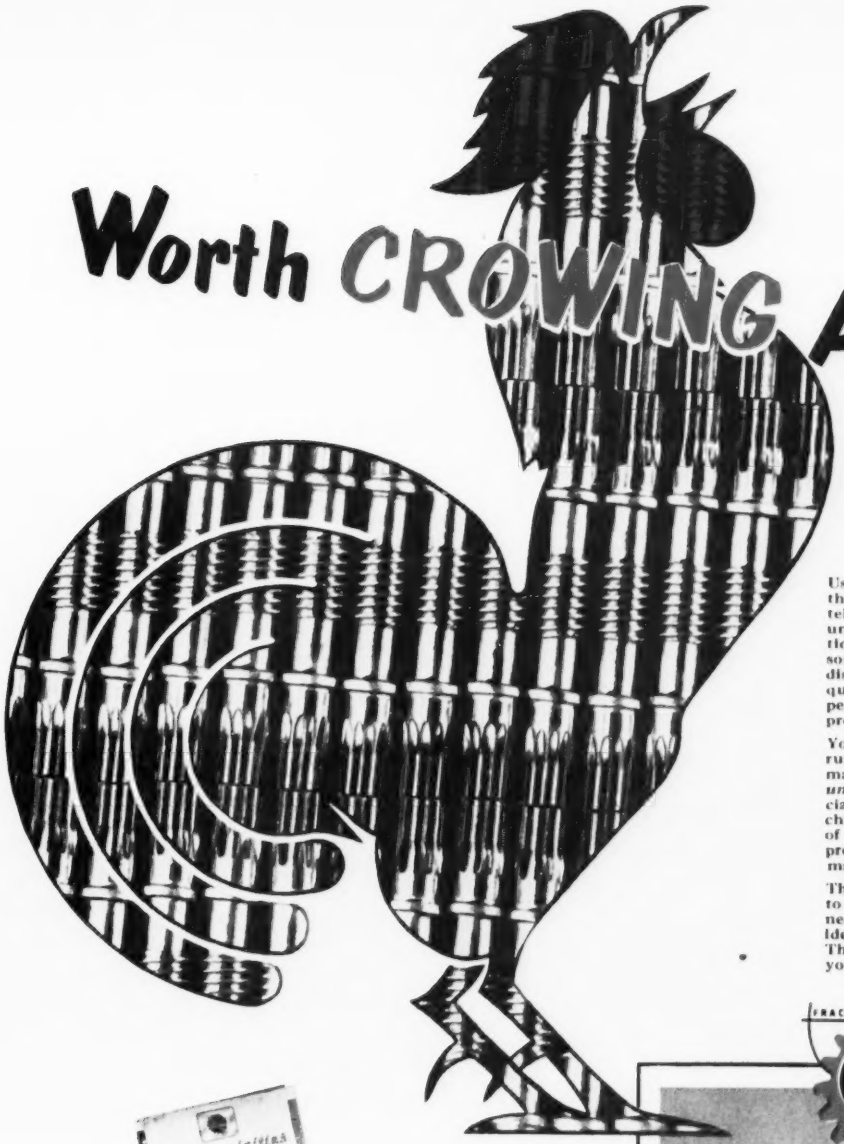
GRINDERS, Pneumatic

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St. Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

(*Continued on page* 338)

For more information on products advertised, use Inquiry Card, page 243

Worth CROWING About...



G. S. FRACTIONAL HORSEPOWER GEARING

Users do most of the "crowing" about the Small Gearing we make! They can tell you, for instance, how the greater uniformity of G. S. Gears keeps production lines rolling. How once troublesome reject problems have practically disappeared! How consistently finer quality has brought smoother, quieter performance and longer life to their products!

You see, each G. S. Gear in a production run of *thousands* measures up to remarkable standards of accuracy and *uniformity*. Here, thru 35 years of specializing, men and methods and machines have been perfected to a degree of mass production efficiency unapproached in the history of fine gear making.

The drawing board stage is a good time to call us about the Small Gearing you need. Let our skilled engineers offer ideas, suggestions, and cost estimates. This valuable service does not obligate you at all!

GET OUR *Free* 6-PAGE FOLDER

See where and how we mass-manufacture Small Gearing to uniformly fine tolerances. This attractively printed 8½ x 11" 6-page folder is punched for ring-binder use. You'll want to keep it handy for frequent reference. It contains 23 pictures of Small Gears, plant views, as well as Diametral and Circular Pitch Tables. Ask for your copy on company stationery, please!

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GEAR
Specialties, Inc.
2635 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARING

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Thor Power Tool Co., Aurora, Ill.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besly-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

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Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

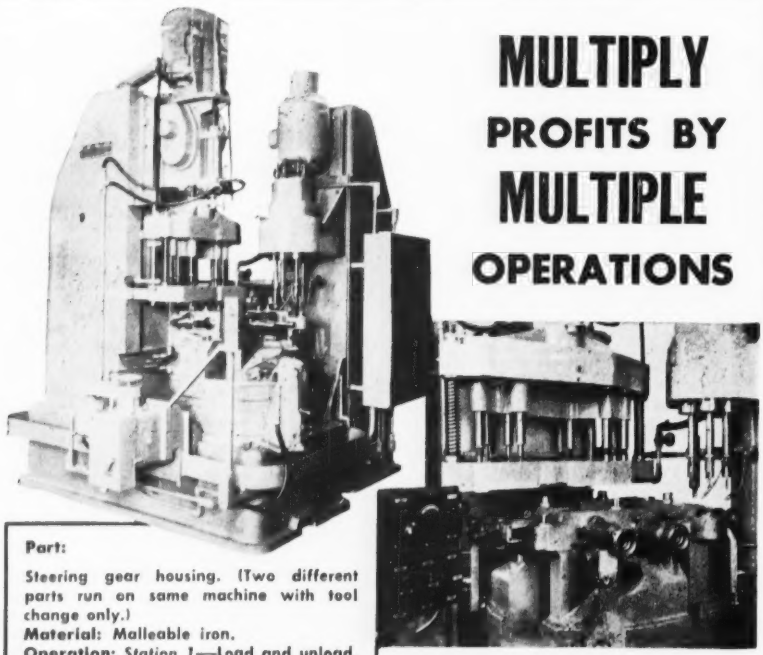
GRINDER MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.

(*Continued on page* 340)



MULTIPLY PROFITS BY MULTIPLE OPERATIONS

Part:

Steering gear housing. (Two different parts run on same machine with tool change only.)

Material: Malleable iron.

Operation: *Station 1*—**Load and unload.** *Station 2*—**Drill (3) .368" holes; (1) .120" hole.** *Station 3*—**Combination spot face and chamfer (3) holes, drill (1) 23/32" hole for tapping.** *Station 4*—**Tap (3) 7/16"-14 NC-3 thread; tap 1/2"-14 NPSF thread.**

Description: Millholland 4-station automatic index machine equipped with 4-station automatic index table, with 1 No. 5 Millholland Automatic Unit driven by 7-1/2 HP motor with 8-spindle ball bearing multiple head for drilling 5 holes and combination spot facing and chamfering 3 holes; 4-spindle tapper on right-hand column.

Operator loads part and pushes button initiating automatic cycle, unloads. Two parts machined at a time.

MILLHOLLAND ENGINEERED FOR MAXIMUM PRODUCTION

For special production machines, Millholland Automatic Units offer distinct advantages. These self-contained units, driven by individual motors, are readily adapted to a wide range of operations. Their full automatic cycle with interlocked controls permits several units to be grouped for simultaneous operations, or they can be mounted on other production machines and synchronized to perform additional operations. Millholland Automatic Units have proved themselves in 30 years of outstanding performance on all types of jobs. Get full details in Bulletin M-2.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd., Indianapolis 2, Indiana

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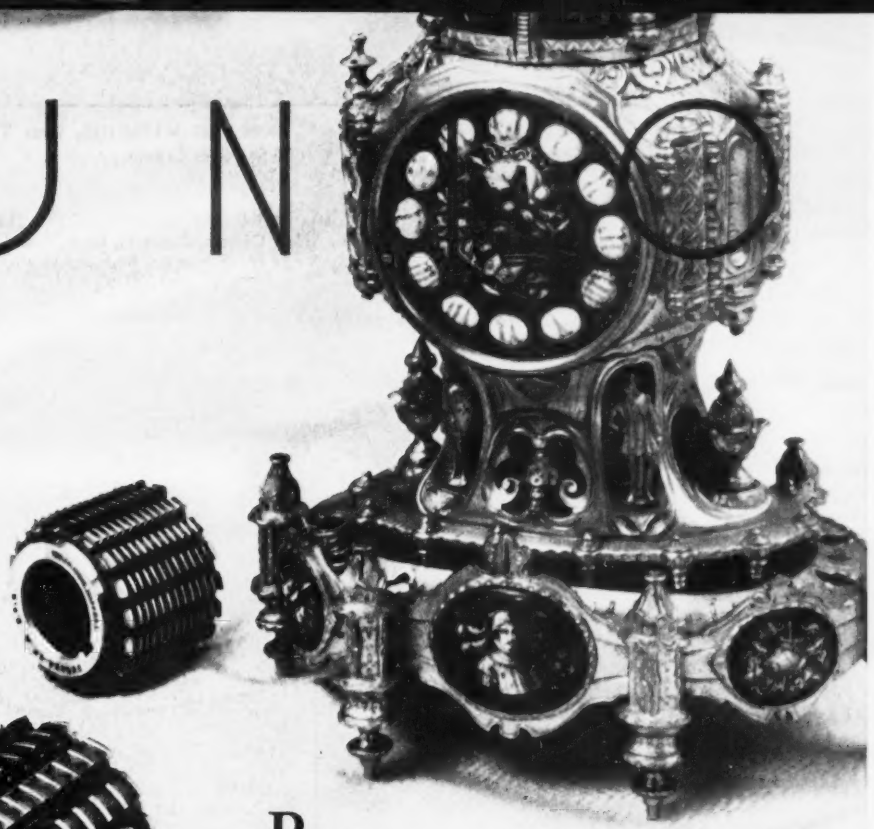
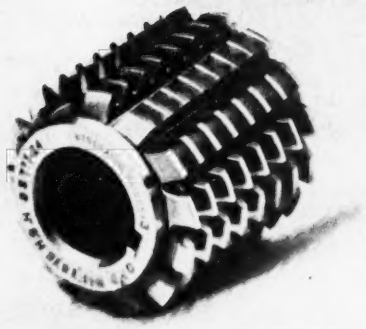
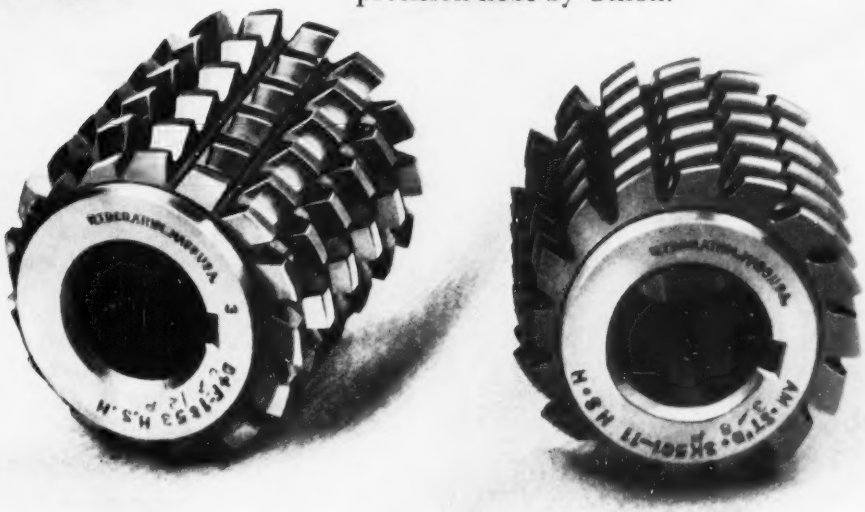




Precision was built into every detail of this Nineteenth Century clock.

Today, the finest gears are mechanically reproduced by means of precision-built hobs. For the best in hobs — demand precision hobs by Union.



Renaissance 19th Century French Clock, made in Paris by RAINGO, *Circa* 1840

HOBS

Involute Spline
Parallel Spline
Worm Gear
Tangential
Spur Gear
Helical Gear
Ground
Unground
Accurate Unground
Finishing
Roughing
Preshave
Protuberance
Stub-Tooth
Standard Gear
Composite Form
Combination Pitch
Topping
Semi-Topping
Non-Topping
Herringbone Gear
Shank Type
Shell Type
Serration
Square Shaft
Tapered Hole
Multiple Thread
Special Shape

SPROCKET

Silent Chain
Roller Chain
Special

UNION TWIST DRILL COMPANY · ATHOL, MASSACHUSETTS

Milling Cutters Gear Cutters Twist Drills Hobs Reamers Carbide Tools

OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
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CUT INVENTORY COSTS, ORDER FROM YOUR LOCAL DISTRIBUTOR

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Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., Beloit, Wis.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
land, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphi,a Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Mattison Machine Works, Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

(Continued on page 344)

HERE'S THE "tap miser" YOU'VE BEEN WAITING FOR!

helps eliminate costly tap breakage shut-downs and excessive work spoilage!

Breaking too many taps?—Tap life shortened? — Spoiling many pieces? — Then check your tapping equipment. Investigate PROCUNIER Tapping attachments. Whether it's continuous or intermittent tapping in soft or hard metals—large or small hole jobs with skilled or unskilled operators—you will find Procunier Tapping machines performing with a new-found ease, a more dependable and consistent accuracy and providing many extra hours of tapping efficiency. Procunier Tappers are gentle to costly taps and tough on maintaining production schedules.

There are many reasons for this Procunier superiority—Procunier Tappers include: cover clamping and quill models which mount rigidly, eliminating chatter and vibration; new, sensitive double-cone friction clutch automatically regulates driving pressure with a soft "cushioned" action; simple, one shot lubrication, ballbearing equipped; heat treated gears with special gear reversing mechanism; unique tap holding spindle support; aluminum housing; plus other important features.

Write for FREE Circular giving complete details and specifications on the complete line of Procunier Tapping Heads.

The exclusive Procunier "Tru-Grip" tap holder is lighter, smaller in diameter. It affords easier tapping close to walls or shoulders, eliminates "chewed" tap shanks. Holds tap true.

Procunier Safety Chuck Co. • **16 S. CLINTON ST., CHICAGO 6, ILL.**

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St., Chicago 6, Ill. Dept. 2

Gentlemen: Please send your illustrated brochure giving complete details, specifications and prices on the improved line of Procunier High Speed Tapping Heads.

Name .....

Address .....

City ..... Zone ..... State .....

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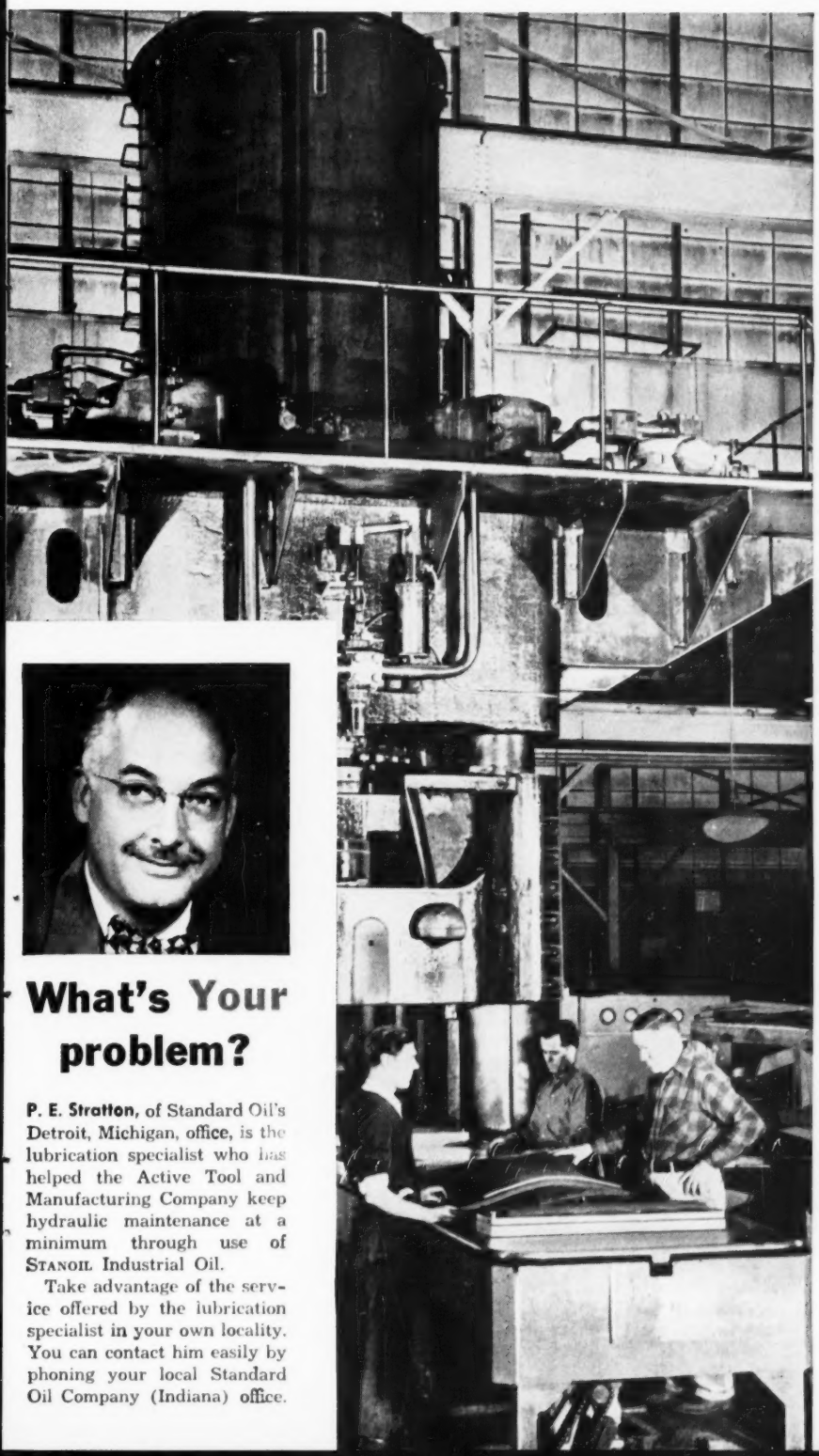
STANOIL
TRADE MARK
Industrial Oil

How they keep hydraulic maintenance to a minimum



What's Your problem?

P. E. Stratton, of Standard Oil's Detroit, Michigan, office, is the lubrication specialist who has helped the Active Tool and Manufacturing Company keep hydraulic maintenance at a minimum through use of STANOIL Industrial Oil.

Take advantage of the service offered by the lubrication specialist in your own locality. You can contact him easily by phoning your local Standard Oil Company (Indiana) office.

● Officials of the Active Tool and Manufacturing Company, Detroit, Michigan, count on trouble-free hydraulic operation of this giant press. They place much of their confidence in the performance of STANOIL Industrial Oil—and with good reason.

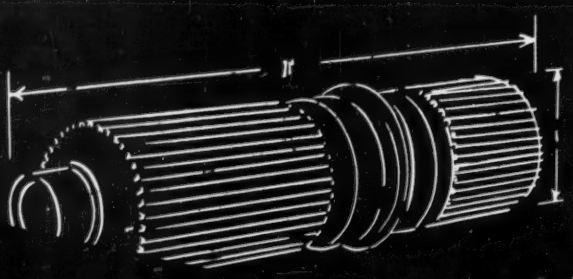
Recommended by a Standard Oil lubrication specialist, STANOIL has served in the hydraulic system of this press for over four years. In all of that time, it has not been necessary to replace the original fill of oil nor has the hydraulic system once needed to be cleaned. Periodic tests of oil samples have shown that STANOIL, despite hard service and high oil-operating temperatures, has maintained a lubricating quality comparable with new oil.

You, too, can rely on this unique, versatile oil to give you clean, dependable service, in a wide variety of equipment. The Standard Oil lubrication specialist serving your area of the Midwest will be glad to show you operating records covering the many applications of STANOIL. Phone him at your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY

(Indiana)



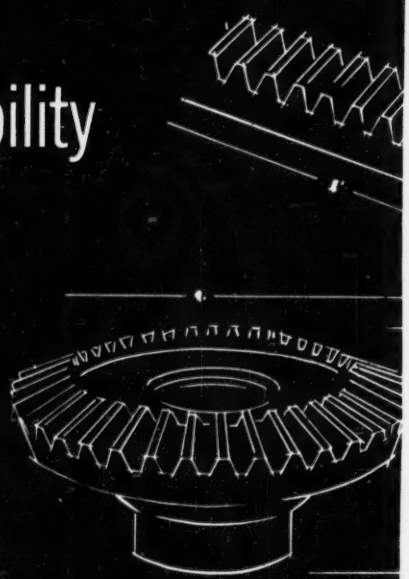
CRUCIBLE

MAX-EL

ALLOY STEEL

optimum machinability

full heat treatment



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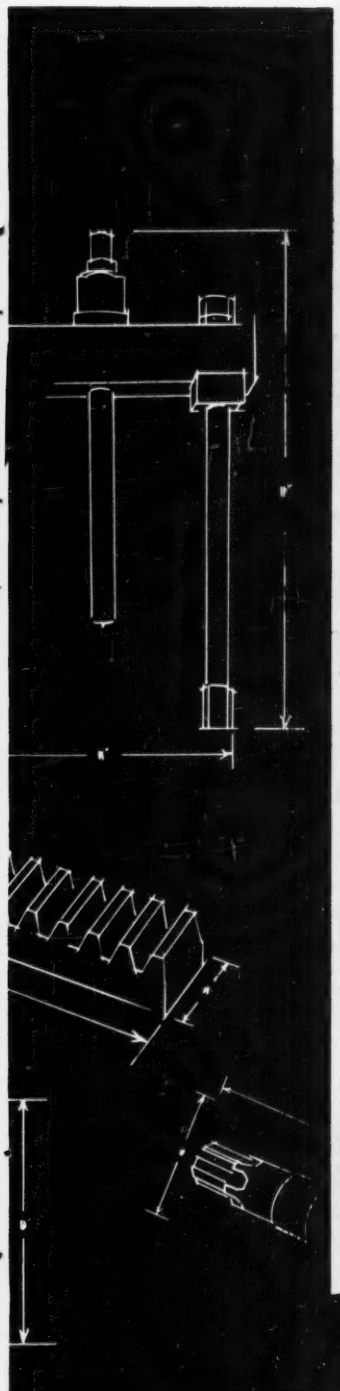


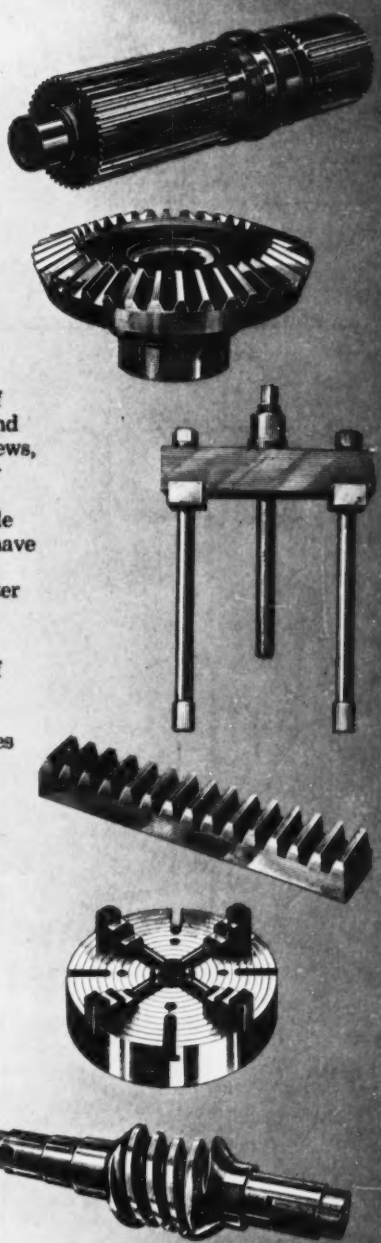
Here's an alloy steel that's a growing favorite of production men in metalworking — MAX-EL. It was developed by Crucible especially to provide a tough, high strength alloy that would be easier to machine after full heat treatment.

What's more, because of Crucible's unique mill set-up, MAX-EL sections are more accurate... bars are straighter — further plus values for the economy-minded production man. And MAX-EL comes in a complete range of sizes and shapes to meet your every need.

MAX-EL has reduced production costs and improved product performance in hundreds of applications such as machine tool spindles and gears, turbine shafts, lathe chuck jaws and screws, thread cutting and die head parts, ditch digger teeth, speed reducer gears and pinions, and truck axles. For MAX-EL is made in Crucible specialty mills where tool and other fine steels have been produced for more than 50 years... where quality is persistently controlled to a far greater degree than in ordinary steelmaking practice.

Then too, you can count on prompt, dependable delivery of MAX-EL regardless of the size of your order. Our special jobbing mill can turn out even 500 pound orders quickly and efficiently. And Crucible warehouses in key cities throughout the country carry stocks of MAX-EL so that in many cases you can get 24-hour delivery direct from a local source.

Crucible also makes a complete line of AISI and SAE alloy steels. So whatever your alloy steel requirements, be sure you *call Crucible.*



MAX-EL ADVANTAGES:

* ***better machinability***
* ***more accurate sections***
* ***straighter bars***
* ***full range of sizes***
* ***prompt delivery — in pounds or tons***

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

NEWARK · NEW HAVEN · NEW YORK · PHILADELPHIA · PITTSBURGH · PROVIDENCE · ROCKFORD · SAN FRANCISCO · SEATTLE · SPRINGFIELD, MASS. · ST. LOUIS · ST. PAUL · SYRACUSE · TORONTO, ONT. · WASHINGTON, D. C.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Besly-Welles Corp., Beloit, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial,

Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Allison Co., Bridgeport, Conn.
Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Bay State Abrasive Products Co., Westboro, Mass.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.

(Continued on page 346)

SHELDON
CHICAGO U.S.A.

OFTEN PAYS OUT ON THE FIRST JOB...

and gives additional years of "cost free" service.

In the past, lathes were generally bought as large and as heavy as possible to insure accuracy and sufficient power. Now, with accurate, low-cost Sheldon Precision lathes, it is more profitable to buy these faster, cost-cutting lathes for the specific job at hand just as you would buy jigs and fixtures.

In savings of tooling costs, operator cost, power cost, and plant loading, as well as extra profits from more pieces per hour, Sheldon lathes often pay back their cost on a single run.

Sheldon lathes will work to the closest tolerances—have "Zero Precision" Taper Roller Bearings. They can take a healthy cut when operating at high speed direct drive—have double V-belts to the spindle. They will swing 10", 11" or 13" and have a 1⅝" hole through the spindle—have sufficient capacity for the great bulk of lathe work. Sheldon lathes have created a new factor for figuring machinery costs. They are tools you should know about.

Write for Catalog

SHELDON MACHINE CO., INC.

4246 N. Knox Ave. Chicago 41, Illinois

For more information on products advertised, use Inquiry Card, page 243

CUT COSTS

with the Original Mead

MIDGET AIR CLAMP

(Spring Return Air Cylinder)

In assembly jigs and other multiple applications, this new, low cost pressure unit saves countless man-hours. As a work-ejector in many fixtures, it is unexcelled.

Only $3.95 EITHER STYLE **($40.80 Per Dozen)**

Advantages over mechanical clamps

1 All Air Clamps in any set-up can be operated by a single master valve—the "lock-up" and release of assemblies is instantaneous.

2 May be installed in cramped corners difficult to reach with bulky mechanical clamps. Mead Midget is the most compact air cylinder, for its power, on the market.

3 Equal ram pressure at any point along stroke, making special, delicate adjustments unnecessary.

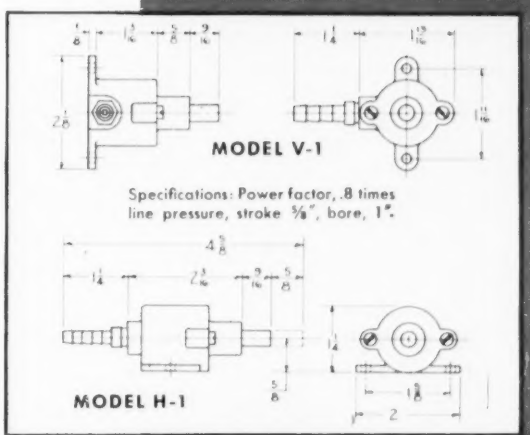
4 Independent group control. Any desired group of "Midgets" can be controlled independently of any other group in an assembly—as where primary members of the fixture must be locked up before the secondary members.

5 Facilitates delicate drill operations. Air Clamps actuated by foot control valves leave operator's hands free to handle the work pieces.

Send for all the interesting facts on these time-tested, superior Midget Air Clamps.

MEAD SPECIALTIES COMPANY

4114 North Knox Avenue • Dept. M-24 • Chicago 41, Illinois



IMMEDIATE DELIVERY

Single-acting cylinders delivered from stock; double-acting in a few days.

Tear Out MEMO Coupon Now For

New MEAD INDUSTRIAL AIR POWER CATALOG

Full of suggestions for faster, cheaper production with famous **MEAD AIR-POWERED** *Cylinders, Valves, Presses, Vises, Chucks, Hammers, Drill Press Feeds, Work Feeders, semi-automatic combinations, etc. Send today.*

Memo Coupon

MEAD SPECIALTIES CO.

4114 N. Knox Ave., DEPT. M-24, Chicago 41, Illinois

Send free copy of new, colored MEAD INDUSTRIAL AIR POWER CATALOG describing the complete line of famous Mead air-operated devices.

Name_____

Company_____

Address_____

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Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., (Surface Grinder) 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

GROOVE PINS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

GROOVING Tools, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

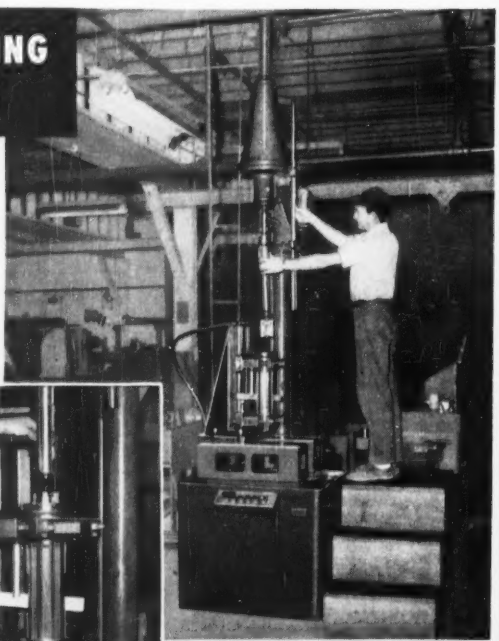
Only TWO EASY STEPS . . . both AMAZINGLY SWIFT AND EFFICIENT

for fast, accurate, uniform precision finishing

FULMER HONING MACHINES

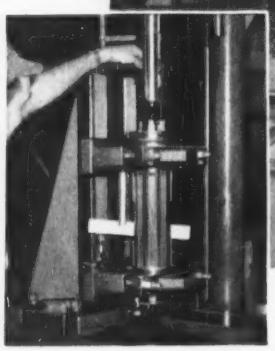
1. Honing stones SHEAR off the protuberances from the internal bores . . . then

2. FINISH the internal surfaces to geometric accuracy so rapidly that as much as 1/16 inch is removed from the diameter at a rate of 1½ to 2 cu. inches or more per minute.



Fulmer Honing Machines speed cutting and finishing and insure dimensional accuracy to tolerance of .0001 (±) in every internal honing operation.

for ferrous and non - ferrous metals, plastics, glass etc.



Photograph shows Fayscott Corporation of Dexter, Maine, honing spindle sleeves for Giddings & Lewis boring mills.

WRITE FOR BULLETIN ON HONING

C. ALLEN FULMER CO.

1231 First National Bank Bldg. Cincinnati 2, Ohio

HAMMERS, Shaft

S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDENING, Surface Treatment

Electrolizing Corp., 1505 East End Ave., Chicago Heights, Ill.

HARDNESS TESTING INSTRUMENTS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HOISTS, Chain, Etc.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric

Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

(Continued on page 348)

For more information on products advertised, use Inquiry Card, page 243

"WE GET BROACHING SERVICE"

by Master Mechanic

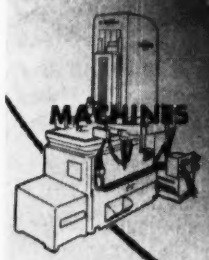
Leading Automotive Parts Maker

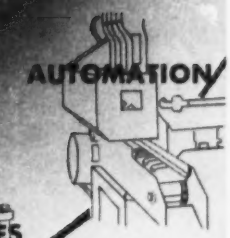
We have been relying on Colonial Broach Company for all phases of broaching—engineering, manufacturing, and service—for over 25 years.

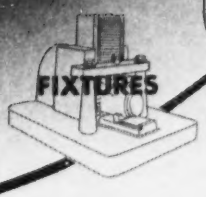
Several of our Colonial 10-ton pull-ups and horizontals have been in continuous use, at times on a three shift basis, since 1936, broaching gears, splines, etc., for tractor and automotive transmissions. Today, over 80% of the broaching machines in our shop, on both internal and surface broaching operations, are Colonials.

Engineering cooperation on fixture design from Colonial is the best. We get exactly what we require for both internal and surface broaching applications, and we get it promptly.

Colonial supplies the greatest percentage of our broaches. Design, accuracy, broach life, and resharpening service are all that we could ask. In all our 25 years of dealings, Colonial has never failed us when we had to have something in a hurry



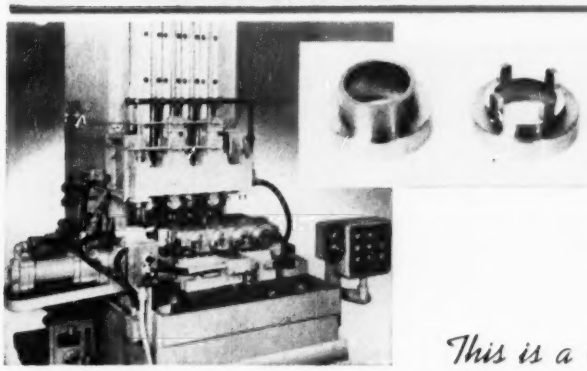




BROACHES

COLONIAL
BROACH CO. DETROIT 13

Unified Broaching



2-STEP BROACHING — 280 GEARS per hr.

Four tangs on 280 automotive oil pump drive gears per hour are broached in two steps on a Colonial RS-10-54 single ram broaching machine. Tangs are 0.345" x 0.431".

Four parts are broached on one side of a 180° indexing shuttle fixture, while broached parts are unloaded from outside stations, semi-finished parts are moved from inner to outer stations, and blanks mounted on inner stations. Fixture recedes, indexes 180° as broach returns, then advances to broaching position, and cycle is repeated.

This is a Colonial Unified Broaching Installation

HONING MACHINES, Internal (Cylinder)

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co. 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.
Superior Hone Corp., 1623 Elreno St., Elkhart, Ind.

HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

HONING TOOLS AND FIXTURES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY Tools and equipment

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co. 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St. Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead , Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston, 35, Mass.
Turchon Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

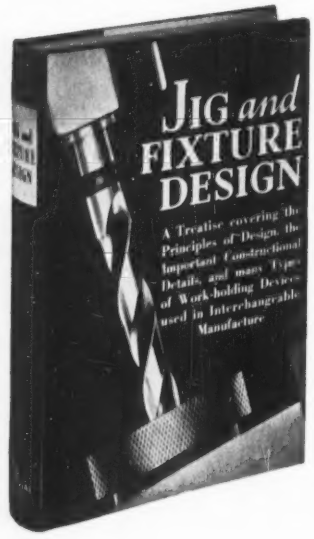
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp, P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

(*Continued on page 350*)

The Right Answers to *Your* Jig Design Problems


JIG and FIXTURE DESIGN
A Treatise covering the Principles of Design, the important Constructional Details, and many Types of Work-holding Devices used in Interchangeable Manufacture

382 Pages
327 Illustrations

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• **JIG AND FIXTURE DESIGN is a thorough and comprehensive treatise covering the principles of design and the important constructional details of all classes of jigs and fixtures. Numerous illustrations (almost one to a page!) show actual examples of many different types of jigs and fixtures used in interchangeable manufacture.**

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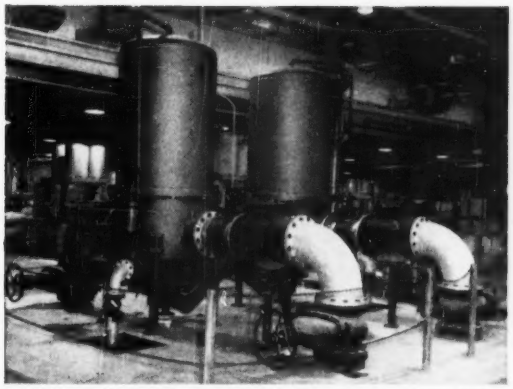
City _____ Zone _____ State _____

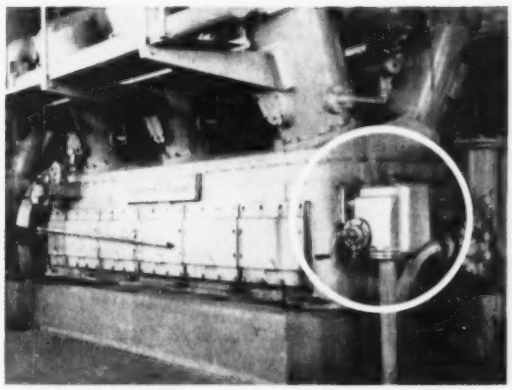
M1/54

For more information on products advertised, use Inquiry Card, page 243

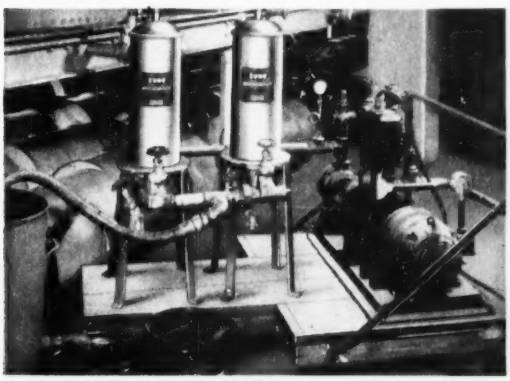
See how Cuno handles any filtration problem



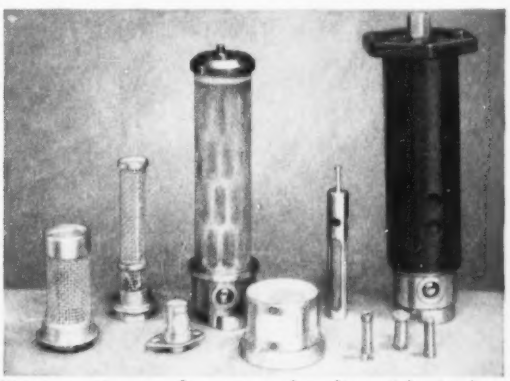
10,000 gallons of water per minute are filtered by six of these Cuno FLO-KLEAN filters, used to remove sand and gravel from incoming well water at pharmaceutical plant. Plant records show that the FLO-KLEANS, by protecting valves and pumps from wear caused by sand, are responsible for saving up to $2000 per month in maintenance costs.



Lubricating oil for modern 600 hp gas compressor is thoroughly strained by four Cuno AUTO-KLEAN filters. The continuously cleanable all-metal AUTO-KLEANS are specified as standard equipment by leading manufacturers of Diesel engines, compressors, pumps, machine tools and other heavy-duty machinery.



Paints and enamels. This Cuno MICRO-KLEAN installation filters enamel being pumped from storage tanks to shipping containers. This micronic media provides finer filtration at lower costs for chemicals, oils, gases, water and many other liquids. Records show that the MICRO-KLEAN element lasts twice as long as ordinary cartridges.



Screens. Cuno makes a complete line of both electrolytically formed and woven screen strainers designed to be built into your product. The electrolytically formed screens are available in nickel; the woven screens of steel, brass, copper, stainless and other alloys are provided in all standard variations of weave.

• We're really proud of our growing list of satisfied customers, like Buda, Bullard, Consolidated Paper, Du Pont, Ingersoll-Rand, Pratt & Whitney, Sherwin-Williams and others who use Cuno filters for anything from acids to tar. They know that if it can be pumped, Cuno can filter it.

We'd like to know about your filtration problem, too. Write for free analysis questionnaire. Cuno Engineering Corporation, Dept. 134 Meriden, Conn.

3.4

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

INDICATORS, Test

Aline Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C. Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Baldwin-Lima-Hamilton Corp., Philadelphia 42.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Northwestern Tool & Engrg. Co., 117 Hollier Dayton Ohio.

JIG BORER

See Boring Machines, Jig.

JIGS AND FIXTURES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
John, B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Northwestern Tool & Engrg. Co., 117 Hollier Dayton Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsacket, R. I.

JOINTS

See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginow Mich.

KNURL HOLDERS

Brown & Sharp Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago Ill.
Pratt & Whitney, West Hartford 1, Conn.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Barnes Drill Co. (Straight Line or Rotating,) 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.).
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.

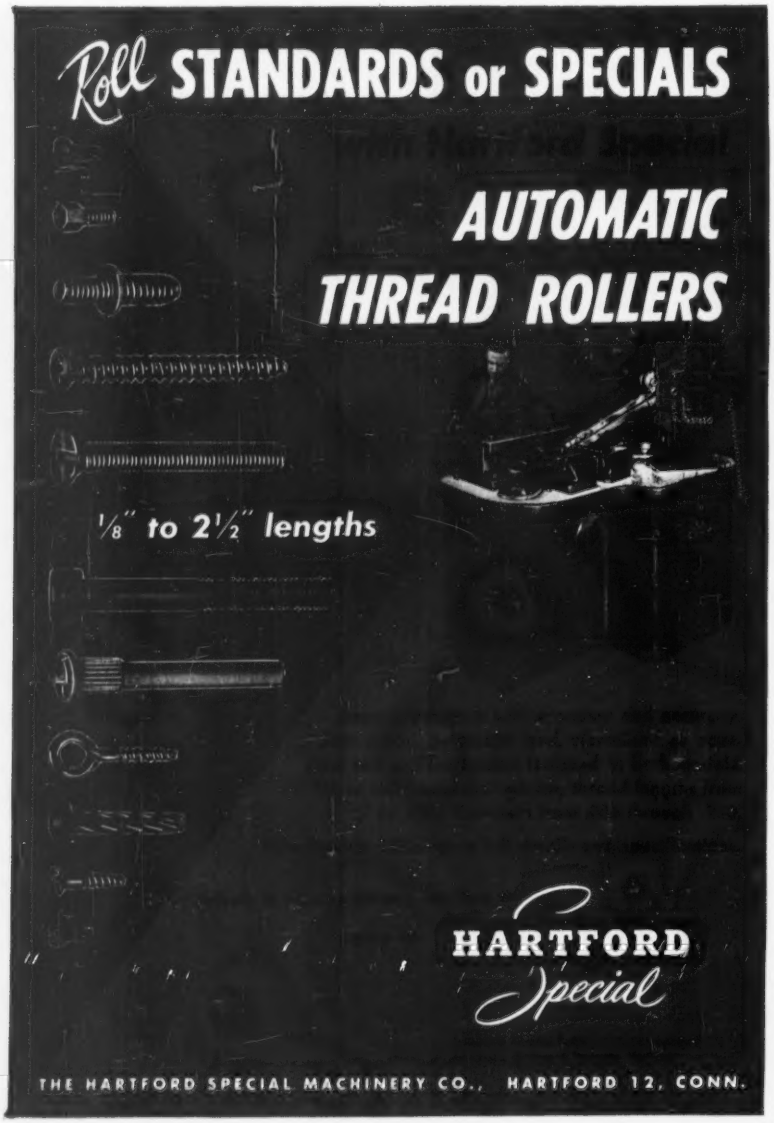
LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hendey Machine Co., Inc., Torrington, Conn.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

(Continued on page 352)

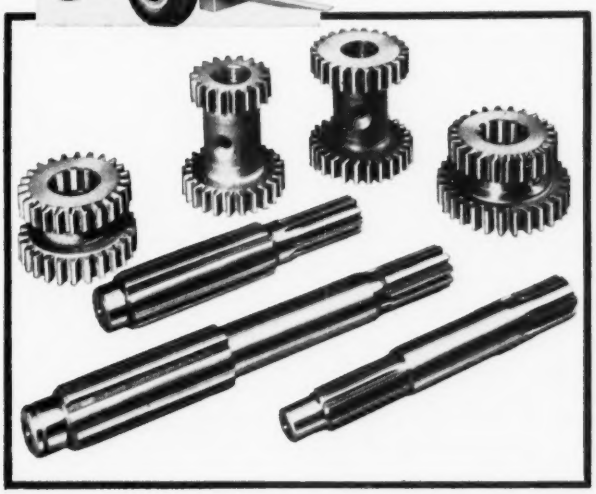


For more information on products advertised, use Inquiry Card, page 243

Specify GEARS OHIO REDUCERS

STOCK or SPECIAL

Pictured here are Ohio Gear's power transmission units used in Towmotor's, 2-ton load, Diesel powered model 480-PD Fork Lift Truck.

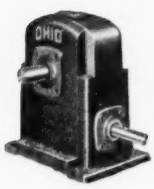


Towmotor's "one man gang" is designed to "take it" and the many factors that go into manufacturing a lift truck must be equally as rugged to withstand a lift truck's round-the-clock grind.

Towmotor units operate the world over — loading ships — lifting steel coils and bars to trucks or stacking lumber, stone and finished products. Do you know of a greater test for gears?

Towmotor depends on Ohio Gears to insure their products' operation and reputation at home and abroad.

Towmotor is another good reason why more automotive designers are specifying Ohio Gears. Perhaps Ohio Gear can do as much for your product. See their nearest distributor or write direct.



ESTABLISHED 1915

THE OHIO GEAR COMPANY

1331 East 179th St., Cleveland 10, Ohio

OHIO GEARS

production begins with

Columbus Die-Tool

Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 46 years. Talk over your special problems with us. Absolutely no obligation. Write today.

Columbus Die-Tool

AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO

ESTABLISHED 1906

Manufacturers of

JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE

SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

FOR PRECISION GROOVING RECESSING AND BACKFACING

Versatile **MAXWELL** recessing tools can be used on any drill press, boring mill, turret lathe, radial drill or milling machine. Ball-bearing pilots and high speed or carbide cutters are interchangeable to handle any job within range of holders.

MAXWELL recessing tools are precision built for sustained accuracy in production runs . . . yet take cuts at unusually high feeds. Features include automatic release to permit rapid indexing and repositioning and easy access to graduated adjusting collar for regulating diameter of recess. 4 sizes available for ⅜ to 4-inch holes.

Write today for literature

1064-MC

THE MAXWELL COMPANY

420 BROADWAY • BEDFORD, OHIO

Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHE CONVERTER

Master Mfg. Co., Hutchinson, Kansas.

LATHES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St. Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls, Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford Ill.

LATHES, Duplicating

H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hendey Machine Co., Inc., Torrington, Conn.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Corp., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(*Continued on page 354*)

For more information on products advertised, use Inquiry Card, page 243

CERUTI
UNIVERSAL BORING MACHINES

NOW SERVING
American Manufacturers

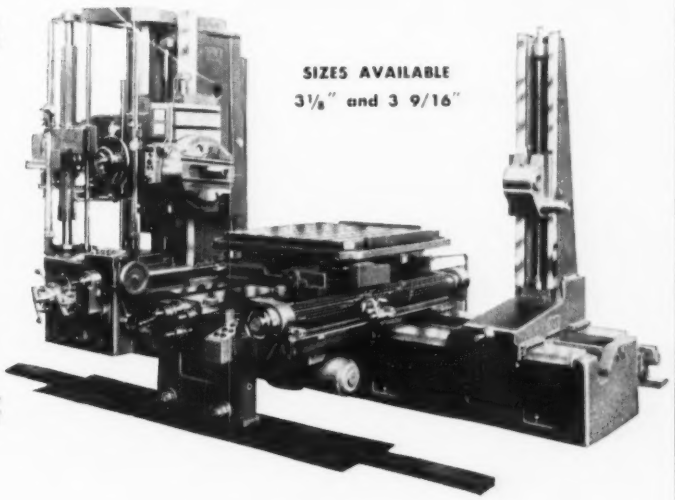
UNIVERSAL BORING MILLS ALEMATIC TYPE

THE ALEMATIC ELIMINATES THE NEED FOR JIGS

Boring holes, either on a short or long production run, can now be accomplished, eliminating the time required for building jigs plus the great expense involved.

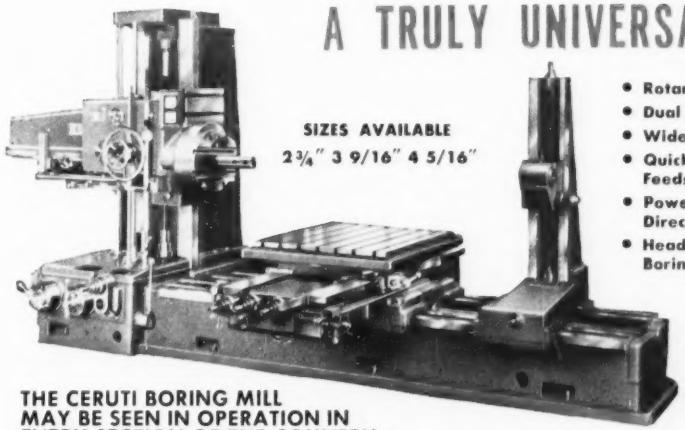
The ALEMATIC is provided with two drums located on the vertical column and the saddle. Each drum has slots in which micrometric dogs are positioned for controlling the vertical and cross slide movements—thus positioning the work piece according to the job requirements.

All other construction features are the same as on the conventional mill described below.



SIZES AVAILABLE
3⅛" and 3 9/16"

A TRULY UNIVERSAL MILL



SIZES AVAILABLE
2¾" 3 9/16" 4 5/16"

- Rotary Motion to Table
- Dual Range of Feeds
- Wide Range of Spindle Speeds
- Quick Acting Lever for Changing Feeds and Speeds
- Power Rapid Traverse in All Directions
- Headstock Permits Simultaneous Boring & Facing
- Centralized Controls
- Pressurized Lubrication
- Built to Insure Greatest Rigidity and Utmost Precision
- The largest model can be supplied with FOUR WAY BED, on special order

THE CERUTI BORING MILL MAY BE SEEN IN OPERATION IN EVERY SECTION OF THE COUNTRY

ATTENTION WEST COAST PLANTS
Inquire About Our Unusual Freight Rate Plan That Will Save You Money.

THE FOLLOWING IS ONLY A PARTIAL LIST OF THE FIRMS THAT USE AND ENDORSE THE CERUTI BORING MILL

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A. O. Smith Co.
Kaiser Manufacturing Co.
Bell Aircraft Corp.
Jeffery Die & Engineering, Inc.
Wright Aeronautical Corp.
Hudson Motor Car Co.
Fairchild Engine & Airplane Corp.
B. & B. Tool & Gauge Co.

ONLY THE FINEST MACHINE TOOLS MADE ANYWHERE ARE DISTRIBUTED BY THE KENNEDY CORPORATION.

FOR COMPLETE INFORMATION WRITE

The KENNEDY Corporation

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POWERFUL FLEXIBLE SHAFT MACHINES

by

Jarvis

Do Your Jobs

EASIER -- FASTER -- MORE ECONOMICALLY!

AN INDUSTRIAL MACHINE FOR INDUSTRIAL USERS

Whether your operations call for GRINDING, CUTTING, BUFFING, SANDING or ROTARY FILING, Jarvis Flexible Shaft Machines are available in BENCH, FLOOR or OVERHEAD Types — in Single or Multiple Speeds to suit your Individual Requirements.

A Jarvis Factory Trained Representative will be pleased to assist you in selecting models best suited to your use.

Jarvis POWER TOOLS

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TAPS • ROTARY FILES
FLEXIBLE SHAFTS and MACHINES • TUNGSTEN CARBIDE REAMERS and MILLS • DRILLS
BORING BITS

Complete catalog upon request.

THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

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Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom
See Lathes, Engine and Toolroom.

LATHES, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS
Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

LUBRICATING SYSTEMS
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Farvel Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

For more information on products advertised, use Inquiry Card, page 243

MACHINE KEYS
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINE PARTS, Special
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS
See Arbors and Mandrels.

MARKING MACHINES AND DEVICES
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.

MASKS, Painting
Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MEASURING MACHINES AND INSTRUMENTS, Precision
Crane Packing Co., 1800 Cuyler Ave., Chicago
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

METAL, Bearings
See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS
See Recording Instruments.

MICROMETERS
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Groton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(Continued on page 356)

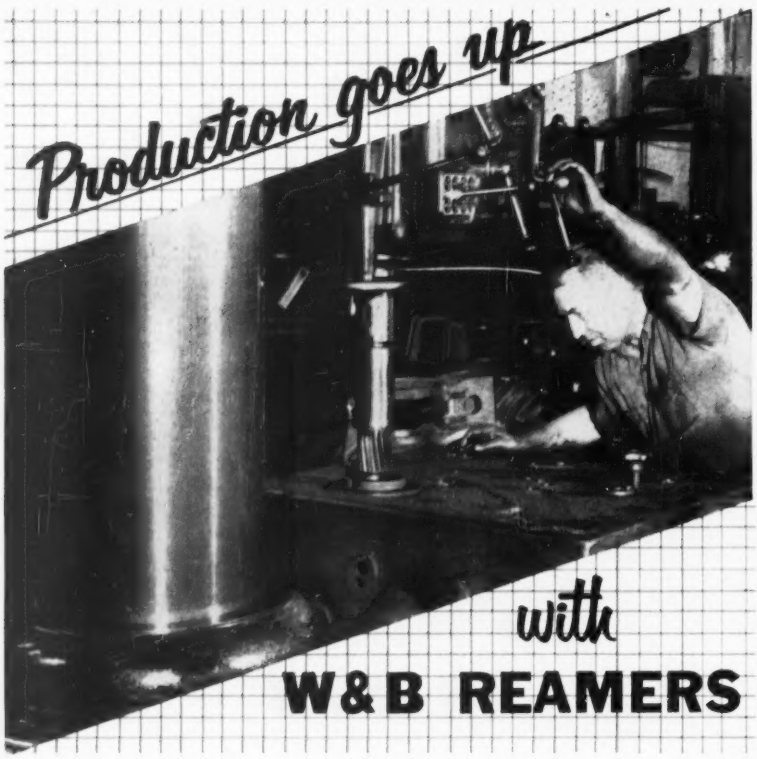
PRECISION MACHINE GROUND-FROM-THE-SOLID

Consistent Exellent Performance — Unusual Economy and Ultra Precision work has firmly established Jarvis Solid Tungsten Carbide Tools among users who know quality.

Make it a point today to write for our completely new 28 page illustrated catalog and the name of the Jarvis representative nearest you.

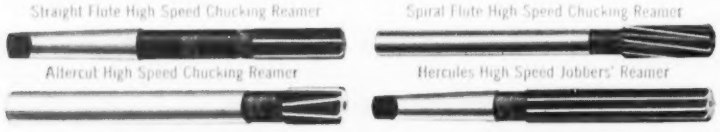
JARVIS POWER TOOLS } TAPPING ATTACHMENTS · TAPS · FLEXIBLE SHAFTS AND MACHINES · ROTARY FILES · TUNGSTEN CARBIDE REAMERS AND MILLS · DRILLS · BORING BITS

THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT



Illustrated above is the reaming of a gear case for an escalator mechanism. A 2.98" diameter Whitman & Barnes shell reamer was used on this reaming operation by a large manufacturer of elevators to secure maximum production, best possible reaming results and reduced costs.

In the complete line of W&B reamers you will find a type and size for nearly every application—each reamer designed and manufactured to the highest standards. Thus, regardless of your reaming application, W&B reamers provide greater production, more holes per grind, longer reamer life, chatter-free operation and accurate holes having super-fine finishes. Be sure your every reaming operation is done with highest efficiency—specify W&B reamers.


Straight Flute High Speed Chucking Reamer
Spiral Flute High Speed Chucking Reamer
Aldercut High Speed Chucking Reamer
Hercules High Speed Jobbers' Reamer

Shown above are but a few of the many reamer types available in the complete W&B line.

W&B

DRILLS
REAMERS
COUNTERBORES
COUNTERSINKS
CARBIDE TOOLS
TOOL BITS
SPECIAL TOOLS

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YOUR INDUSTRIAL DISTRIBUTOR
Can Give You Quick Service
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NEW YORK • CHICAGO • LOS ANGELES • HOUSTON • ATLANTA

MILLING MACHINES, Automatic

Adcock & Shipley Ltd., Ash St., Leicester, England
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Adcock & Shipley Ltd., Ash St., Leicester, England
Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

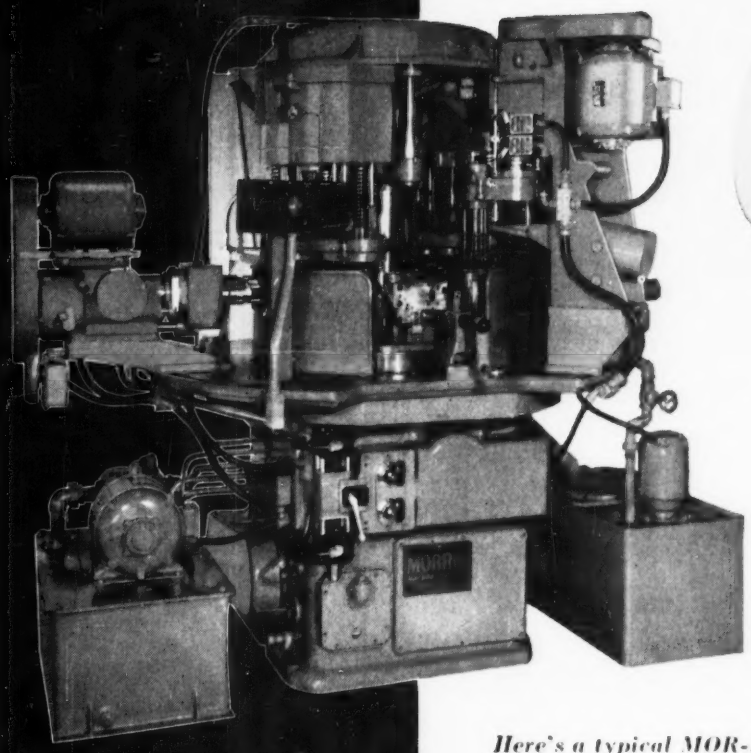
Adcock & Shipley Ltd., Ash St., Leicester, England
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Fray Machine Tool Co., 151 W. Windsor Rd., Glendale 4, Calif.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st. St., Milwaukee 14, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

(*Continued on page 358*)

For more information on products advertised, use Inquiry Card, page 243

how little does it cost...

to get "special machine" production with combination standard units?



Producing 170 finished transmission control valve bodies per hour at 100% efficiency, this machine performs 32 drilling and tapping operations in two cycles.

Here's a typical MOR-SPEED answer to an ever-more important problem:

A combination of Morris standard units . . . center column, base, indexing mechanism and hydraulic units . . . plus a made-to-order vertical and auxiliary side heads . . . make up this high production machine. Cost is less, delivery faster . . . the user gets the accuracy and low cost production of a "special" without the usual sky-high costs and limited application of conventional units.

Consider the multiple savings . . . investment, labor, time and floor space . . . of MOR-SPEED multiple machining. Let Morris Engineers prove that high production *and* precision can be yours for less than you might imagine.

a better product at less cost with precision - plus production

Builders of MOR-SPEED Line

Morris

THE MORRIS MACHINE TOOL CO.

946 HARRIET ST., CINCINNATI 3, OHIO

for better gears...

CAREFULLY CONTROLLED HEAT TREATING

To more efficiently produce the specially heat treated custom gears for which we've become famous, we have complete heat treating facilities adjacent to our modern gear manufacturing plant. Because of the close production and quality control made possible by our integrated facilities, we can produce the *best* in special heat treated custom gears, and produce them economically. Next time you need heat treated gears, remember The Cincinnati Gear Company does the whole job—and does it right!

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INTERNAL
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HELICAL
HERRINGBONE
*CONIFLEX BEVEL
SPLINE SHAFT

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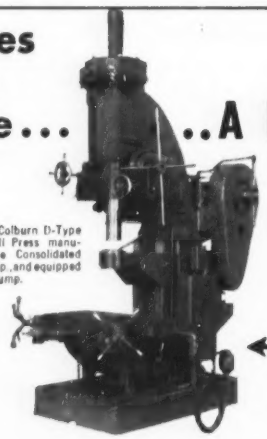
THE CINCINNATI GEAR COMPANY

"Gears... Good Gears Only"

Wooster Pike and Mariemont Ave. • Cincinnati 27, Ohio

Saves You Time... ..A RUTHMAN GUSHER COOLANT PUMP



Illustrated is a Colburn D-Type Heavy Duty Drill Press manufactured by the Consolidated Machine Tool Corp., and equipped with a Gusher Pump.

You get split second coolant flow, controllable as to volume, with a Ruthman Gusher Coolant Pump. There is no need for packing or priming and the pre-lubricated heavy-duty ball bearings need no further attention. You'll save valuable time for the entire life of your metal cutting machinery when you specify Gusher Coolant Pumps.

Write now for full information.

THE RUTHMAN MACHINERY CO.

1807 Reading Road Cincinnati 2, Ohio

Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R. Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Groton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES

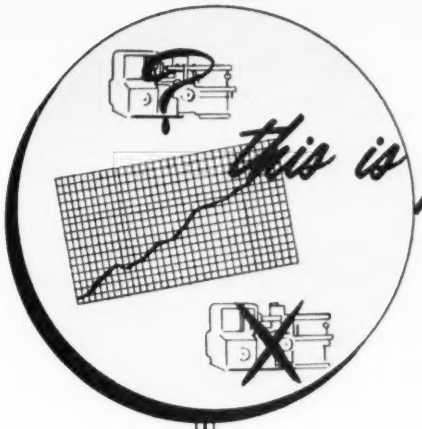
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

(*Continued on page 360*)

For more information on products advertised, use Inquiry Card, page 243



this is your problem in 1954!

Industry is now planning the rejuvenation of its manufacturing processes and equipment for the competitive era ahead.*

It's a time-consuming job.

How can it be *speeded up* for *you?*

**see the 1953 ASTE Obsolescence Report.*

what ASTE is doing to help you

The American Society of Tool Engineers is assembling in Philadelphia's Convention Center on April 26 to 30 inclusive the latest in production equipment and processes available from over 450 manufacturers. The exhibits will be open to you and your key men during these five days, from 9:00 A.M. to 5:00 P.M. Included will be inspection and automation devices, machine tools, accessories, cutting tools, and allied equipment.

Simultaneously, a series of top-level Conferences will be held dealing with such major industrial problems as Plant Management, Automation, Precision Control, Metal Forming, and Assembly Methods.

it's up to your key men NOW!

. . . whether your company moves forward or falls behind in the competitive era ahead. To help you select the key men in your organization who definitely should visit the Exposition, the ASTE has prepared a "plan booklet" which covers every aspect of the ASTE Exposition and Conferences. Write today for a copy on your company letterhead. It will be mailed to you promptly, free of charge.

Available on request to all industrial executives.

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Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motor Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

MOTORS, Hydraulic

Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

Nilson Machine Co., A. H., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel

International Nickel Co., Inc., 67 Wall St., New York, N. Y.
Wales-Strippit Corp., N. Tonawanda, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL CUPS

Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL EXTRACTORS AND CLEANERS

De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS

Wicaco Machine Co., Stenton Ave. and Louden St., Philadelphia, Pa.

OIL-HOLE COVERS

Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL SEALS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting

See Cutting and Grinding Fluids.

OILS, Lubricating

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

OILS, Quenching and Tempering

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Spelial

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PAINTING EQUIPMENT, Spray

Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis 7, Ind.

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, BRASS AND COPPER

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE STEEL

Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves, Detroit, Mich.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTIC AND PLASTIC PRODUCTS

Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

PNEUMATIC EQUIPMENT

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

(*Continued on page 362*)

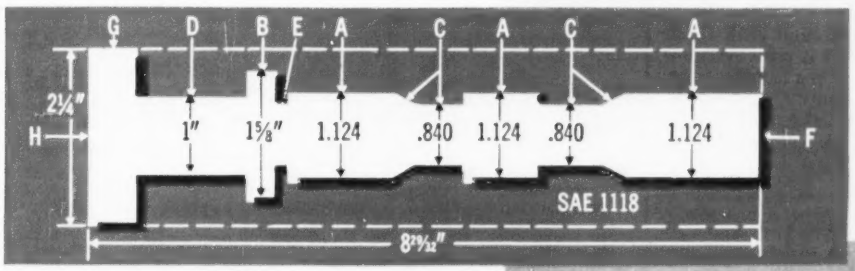
This is the difference High Velocity Turning makes

this job took...

11.50 min.

FLOOR TO FLOOR

A. Turn — 694 RPM — .015″ Feed
B. Turn — 489 RPM — .015″ Feed
C. } Form — 119 RPM — .0025″ Feed
D. }
E. Face, shoulder, neck, undercut, HSS
F. Face 243 RPM — .0035″ Feed
G. Knurl
H. Cut off — 243 RPM — .0035″ Feed



IN 1954 this same job takes...

5.00 min.

FLOOR TO FLOOR

A. Turn — 1000 RPM — .022″ Feed
B. Turn — 1000 RPM — .022″ Feed
C. } Form — 340 RPM — .0035″ Feed
D. }
E. Face, shoulder, neck, undercut
F. Face 489 RPM — .0055″ Feed
G. Knurl
H. Cut off — 489 RPM — .0055″ Feed

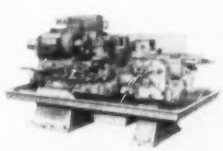
J & L TURRET LATHES GIVE...

MORE Ease of Operation
MORE Power Transmission
MORE Rigidity
MORE Accurate Stops
MORE Efficient Lubrication
MORE Coolant on Cutting Tools
MORE Accurate Results

Turning out a job like this in 5 min. calls for a lathe with plenty of power and the beef to back it up . . . a lathe like the Jones & Lamson #7A Universal Turret Lathe, which is specially designed to meet today's demand for more production at lower unit costs.

Only with a lathe like this can your shop take full advantage of the quality, productivity and lower costs offered by High Velocity Turning.

This job is one of the many turned at high speeds on our production line. Come to Springfield and see for yourself. At any rate, send for catalogs #101-A and #102.



JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

J&L MACHINE TOOL DIV.

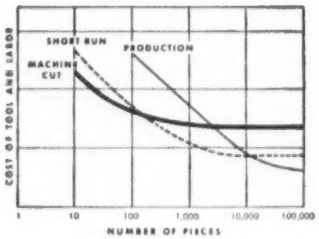
For more information on products advertised, use Inquiry Card, page 243

STAMPINGS

Our impartial use of three basic methods gives you economy regardless of length of run.

Most parts can be made by all three methods. But only **one** is **most** economical. The right decision is a technical one, based on **over-all** quantity, contour dimensions, tolerances and materials.

YOUR SUPPLIER SHOULD KNOW ALL THREE METHODS



This logarithmic chart shows the effect of these factors on the **specific part** illustrated. From 1 to 150 parts, our own **Machine-Cut Method** with no die cost whatsoever is most economical. At 150 parts, the **Short-Run Method** using economical blanking dies and stock punches is best. At 10,000 units, the standard **Production Method** with standard dies is most satisfactory.

For more information, use coupon on opposite page

STAMPINGS DIVISION

LAMINATED SHIM COMPANY, INC.

3902 Union Street, Glenbrook, Conn.

Thor Power Tool Co., Aurora, Ill.

POLISHING LATHES AND MACHINES

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Gardner Machine Co., (Div. Landis Tool Co.), 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Jarvis, Charles L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Air

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilburn Ave., Chicago.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Die Tryout

Alpha Tool Works, 9281 Freeland Ave., Detroit 28, Mich.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
B & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Clifton Hydraulic Press Co., Clifton, N. J.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St. Chicago 44, Ill.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo.

For more information on products advertised, use Inquiry Card, page 243

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Niles Service Mch. Tool Co., 2363 University Ave., St Paul, Minn.
Verson Allsteel Press Co. 93rd St. and S. Kenwood Ave., Chicago, Ill.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div., Oliver Corp., 21 Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engra. Co., Alliance, Ohio.
Niagara Machine & Tool Works, (Hydraulic) 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa., (Lathe).

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N.Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Mchry. Co., Inc. (and affiliated companies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pines Engineering Co., Inc., Aurora, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

(*Continued on page 364*)

SHIMS

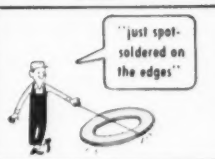
BRING YOUR SHIM PROBLEMS TO "SHIM HEADQUARTERS"

ONLY LAMINATED SHIM COMPANY OFFERS YOU ALL FIVE SOLUTIONS:

THE LAMINUM® SHIM

SIMPLY PEELS FOR ADJUSTMENT
Made up of from 3 to 63 layers of .002 or .003 inch brass or steel, metallically bonded together over their entire surfaces. No dirt between layers. Peels with penknife.

THE LAMISOL® SHIM



FOR QUICK, ASSEMBLY LINE USE
The laminations of the LAMISOL Shim (in brass only) are temporarily joined by spot-soldering on the edges. Gauges and number of laminations within one shim are unlimited.

THE LAMITAB® SHIM

FOR SUPER SPEED, THIN GAUGE SITUATIONS
The little tab holds shim laminations together firmly, yet is easily removed. Different metals can be used in the same shim.

THE LOOSE LEAF SHIM

FOR UNLIMITED FLEXIBILITY
This is the simplest of all custom-stamped shims. It is completely flexible. Usually sets including several different gauges are made up.

PACKAGED SHIM STOCK

READY FOR EASY USE, WITHOUT WASTE
Thin gauge 6" x 100" rolls feed through package slots. Heavier gauges in flat envelopes. Available from your Industrial Distributor.

*T.M. Applied For

LAMINATED SHIM COMPANY, INC.

SHIM HEADQUARTERS SINCE 1913

Check Our Stampings Division
For Your Stamped Parts Requirements

USE COUPON for more information

MAIL TODAY!

LAMINATED SHIM COMPANY, INC.
3902 UNION STREET, GLENBROOK, CONN.

Please send me more information on:

☐ SHIMS ☐ STAMPINGS ☐ BOTH

☐ *We'd like to discuss our problem with one of your Sales Engineers.*

NAME _____ TITLE _____

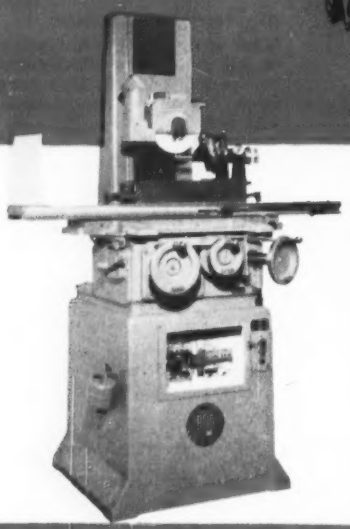
COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

REID
SURFACE GRINDERS

have built-in accuracy for top performance in your toolroom



Every part in a Reid is designed and engineered to provide the extreme accuracy that toolmakers require for dependable results on fine tooling. Each feature which contributes to more precise work is rigidly tested, under acutal shop conditions, to determine its *right* to be part of a Reid Grinder. Not until the value of each individual feature is proved — in terms of top performance — is it presented to industry. A Reid Surface Grinder will prove a sound investment in quality production for *your* toolroom.

Better Surface Finish

. . . with the motorized spindle turning on pre-loaded bearings to eliminate wheel chatter, and the work table running smoothly on hand-scraped ways, ground pieces have a visibly finer surface finish.

Easier Operation

. . . finger-tip level controls eliminate stretching and bending, lessen operator fatigue. And, the electrical controls are fully visible, yet protected behind a transparent shatter-proof panel.

Rugged Design

. . . all mechanical units built around rugged one-piece column casting to insure permanent alignment of cross-slide saddleways and vertical headways. Column is mounted on heavy cast iron base for maximum rigidity and freedom from vibration.

Capacity-

6" x 18" x 17¼" from center of spindle to worktable. Table speed (Model 618V) 12 to 35 feet per minute.

PLAN FOR REPLACEMENT!

Get full details on Reid Grinders with built-in accuracy for better performance — please request Bulletin 618-2

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Ill.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

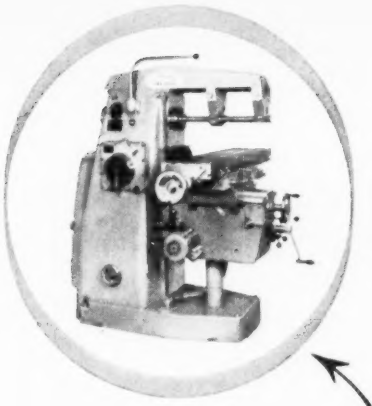
PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Famco Machine Tool Co., 3134 Sheridan Rd., Kenosha, Wis.

(*Continued on page* 366)

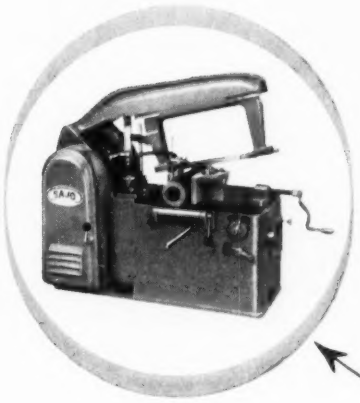
For more information on products advertised, use Inquiry Card, page 243

Swedish Craftsmanship!



headquarters

FOR THE FINEST SWEDISH MACHINE TOOLS



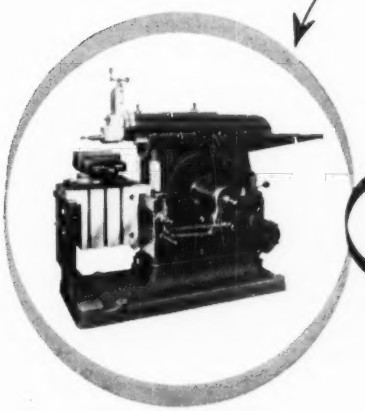
Austin is American headquarters for the fine machine tools that are manufactured in the modern Swedish machine tool center of Värnamo.

Built with the painstaking workmanship and quality materials that characterize Swedish products, these machine tools, since their introduction in the U.S.A., have earned an enviable reputation for accuracy and dependability in toolroom and production line. All machines comply fully with U. S. Standards.

SAJO #2 ALL GEARED MILLING MACHINES — plain and universal models — light and standard types, all built to modern design to meet industry's demand for fast, simplified operation while maintaining maximum accuracy. Available with longitudinal power feed only or with power feed and rapid traverse in all directions. Offered with full line of accessories.

SAJO HYDRAULIC HACKSAWS — Utility and Production Models — 6" x 6", 9" x 9" and 10" x 10" capacities. These sturdy machines, for intermittent or production duty, have unique patented features and are attractively priced. Sajo Hacksaws represent exceptional values in cutting off equipment.

PREMA 13" SHAPER — a "mighty mite" — ideal for applications where large shapers are not justified. "Big Shaper" performance and accuracy at modest cost makes the Prema a profitable addition in the toolroom or on light production work.



VMA SHAPERS are available in both standard and heavy duty models — 14" to 26" length of stroke. These rugged amply powered machines provide speedy set-up, ease of operation and maximum stamina in the toolroom or production line. Automatic lubrication and table power rapid traverse are standard on heavy duty models. Universal table and other accessories are available.

Service and spare parts available from us or from our dealers in principal cities.

For complete details, illustrated catalogs and information as to reference installation in your vicinity write to

austin INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE, P. O. BOX 430, WHITE PLAINS, N. Y.

Look for the Austin Seal — your full guarantee of satisfaction.

Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wales-Strippit Corp., N. Tonawanda, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Greaves Machine Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS for Counting

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

REELS, Stock, Standard and Automatic

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.

Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Thor Power Tool Co., Aurora, Ill.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.

RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS

Garlock Packing Co., Palmyra, N. Y.

RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

SANDERS

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburgh, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.

(*Continued on page* 369)

NO GETTING AROUND IT!

In All These 18 Applications De Laval Purification Pays Off!

Almost every metalworking plant has one or more operations where an adequate supply of clean, dry oil is a virtual necessity. 18 such applications are suggested in the panel and in every case a De Laval Oil Purifier provides the quickest, low-cost method of keeping these oils ***clean*** and ***dry***.

Clean oil is the prime requisite in most cases. Because of the greater intensity of centrifugal force, De Laval machines are more thorough than any other means. They remove every bit of dirt, abrasive or metallic particles. Thus, cutting oil can be used safely over and over again, with increased tool life and possibly less dermatitis among the men. Dies last longer when drawing oil is centrifuged; tests are more reliable when testing oil is purified.

Dryness can be a most vital consideration, as in the case of slushing compound purification. Here, too, De Lavals do the best work, quickest and most thoroughly. Water removed from the oil is continuously discharged—cannot possibly lead to recontamination.

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CUTTING OIL • DRAWING OIL
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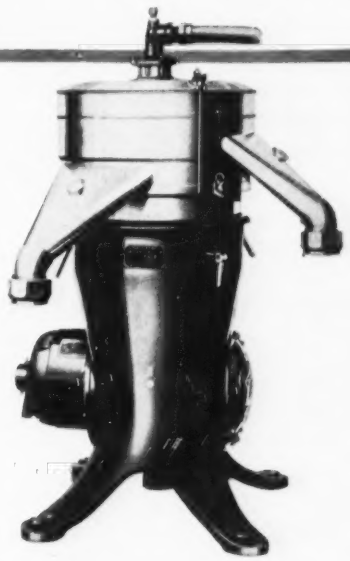
HYDRAULIC OIL • RECOIL OIL
LUBRICATING OIL
SHOCK ABSORBER OIL
QUENCHING OIL
SLUSHING OIL
TRANSMISSION OIL
WASHING OIL



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PURIFIERS AND CLARIFIERS FOR FACTORY OILS

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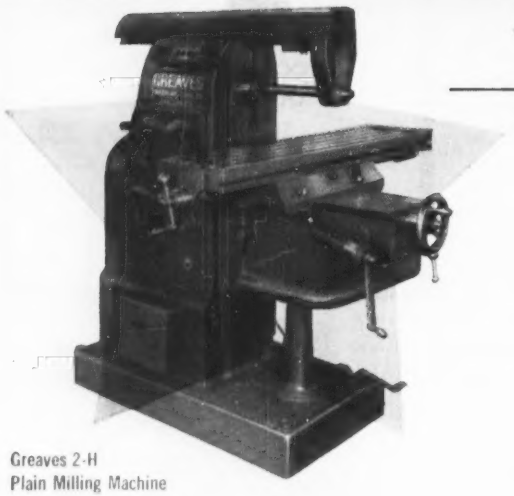
For more information on products advertised, use Inquiry Card, page 243

2 GREAVES stars

End milling bayonet lock slot in precision gear hobbing arbor using dividing head on Greaves 2H Universal milling machine.



Greaves 2-H
Plain Milling Machine

☆plain
☆universal
milling machines

The Stars of the modern milling machine department: Greaves plain and universal milling machines. They're accurate, powerful, with speed and capacity to spare.

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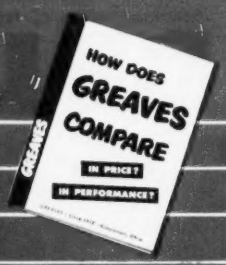
Please send me chart comparing the 8 leading U.S. milling machines for price, capacity, power and other significant specifications.



For more information on products advertised, use Inquiry Card, page 243

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp., 401 Broadway, New York 13, N. Y. (Portable).
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co. 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., E. Penna, Ave., Towson, Md.
Millers Falls Co., Greenfield, Ohio

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave., and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand See aso Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 370)

SEALS AND RETAINERS, Oil or Grease

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770 Saginaw, Mich.
Morey Machry, Co., Inc., 410 Broome St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg. Cleveland 1 Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557 Pittsburgh, 30, Pa.

SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hendey Machine Co., Inc., Torrington, Conn.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Cold Drawn Steel

Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div. Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilburn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheriden Rd., Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron &R. R. Co., Div.), 436 7th Ave. Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Street Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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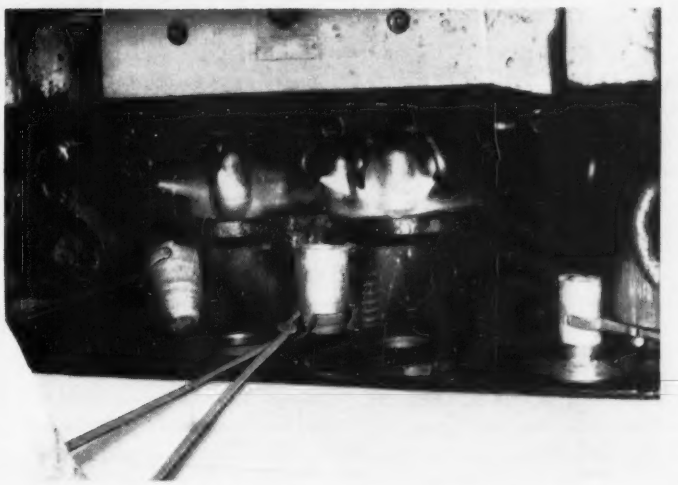
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baker Bros., Inc., Sta. F., P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.

(Continued on page 372)

500 81-MM Shell Blanks Per Hour on a 1,600-Ton High Speed Forging Maxipres!



Upset slugs, heated to 2100°F., are cupped by extrusion, then shaped in forming die. High-pressure jets of mixed air and water keep punches and dies cooled to about 550°F.

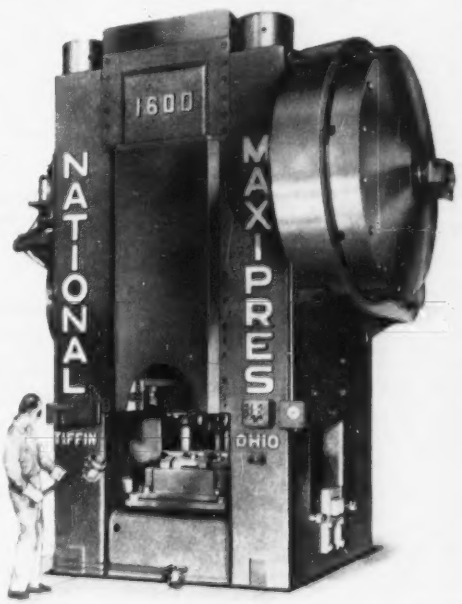
Slugs for 81-MM mortar shells are sheared from 2½ inch round bars of carbon steel. Slugs are then upset preparatory to extrusion (center illustration).

Upset slugs are extruded, then formed into cups (right).

● An outstanding production record is being established at Rheem Mfg. Co., progressive West Coast ordnance forgers, where 81-MM mortar shell blanks are being forged on a 1,600-ton National MAXIPRES at the rate of 500 blanks per hour!

Dies, developed in cooperation with NATIONAL engineers, are giving exceptionally long service. The punches have produced 14,000 to 16,000 pieces, average. After forming 15,000 cups, one die was polished, and produced another 63,000 pieces before showing much wear!

If you have a forging problem—large or small, hot or cold, ferrous or non-ferrous—let us help you solve it. Send us prints, or a sample part, or, better yet, visit us. No obligation.



MAXIPRESSES are available in 13 sizes from 300- to 8,000-tons.

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Blanchard Mch. Co., 64 State St., Cambridge, Mass.
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Consolidated Mch. Tool Corp., Rochester, N.Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp. 1200 Oakman Blvd., Detroit 32, Mich.
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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
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Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
John, B. Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch Match & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Waltham Machine Works, Newton St., Waltham Mass.
Wicoco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectary, N. Y.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STAMPINGS, Sheet Metal

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Laminated Shim Co., Inc., Glenbrook, Conn.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Stele Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Scenter No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co. Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div.) 436 7th Ave., Pittsburgh, Pa.,
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg, Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St. Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Redeemer, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div. Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

(Continued on page 374)

WHAT DOES FIRTH STERLING OFFER YOU?

(ANSWER NUMBER 4)

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Our objective is to help *you* solve the technical and metallurgical problems of an *atomic* age *before* they arise . . . not *after*. So, at Firth Sterling, constant emphasis is on full-scale research, development, and production in specialty steels, carbides, new metals, and new methods.

Out of this determination to be ahead, not just abreast of need, has come this amazing three year record of achievement in *your* interest:

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- Cermets—those amazing hybrids of ceramic and metal, possessing in *combination* the best characteristics of each, to overcome modern technological problems.
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Firth Sterling Stands for Metallurgical Achievement—Past, Present, Future

*Write for reprint of article from Oct. 19, 1953 issue of STEEL.

I-4

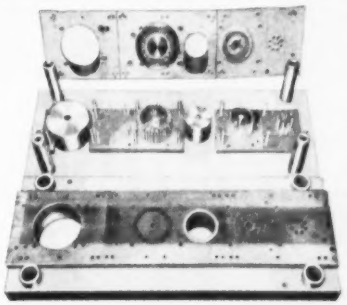
A VERSATILE FAMILY OF *Tool and Die Steels.*

CROMOVAN • AIRVAN • INVARO

Certain steels or families of steel stand out as having almost universal application for general use, ranging from moderate to high production as job requirements demand. One such Firth Sterling family of steels consists of CROMOVAN, AIRVAN, and INVARO. CROMOVAN and AIRVAN are air hardening; INVARO is oil hardening.

ANALYSES

	CROMOVAN	AIRVAN	INVARO
Carbon	1.60%	1.00%	.90%
Chromium	12.50%	5.25%	.50%
Vanadium	1.00%	.25%	.20%
Molybdenum	1.00%	1.15%	—
Manganese	—	—	1.15%
Tungsten	—	—	.50%



Generally speaking, CROMOVAN is intended for long production runs where hundreds of thousands or millions of pieces must be produced at minimum cost; AIRVAN for intermediate runs where toughness and high abrasion resistance are also requirements; INVARO, an oil hardening tool steel for all other general use.

Full technical details are available in these free bulletins. Write for them today or ask your Firth Sterling representative to call and discuss your tool and die needs . . . steel *or* carbide.

P-1

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Tool & Die Steels
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For more information on products advertised, use Inquiry Card, page 243

STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenters Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

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Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

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Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

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Norton Co., 1 New Bond St., Worcester 6, Mass.

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Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

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Wales-Strippit Corp., N. Tonawanda, N. Y.

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Errington Mechanical Laboratory Inc. 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

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SUPERFINISHING MACHINES
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SURFACE PLATES
See Plates, Surface

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Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

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Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
Control Products, Inc., (Waterproof and Thermal), 306 Sussex St., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

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Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

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Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3 Ohio.

TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

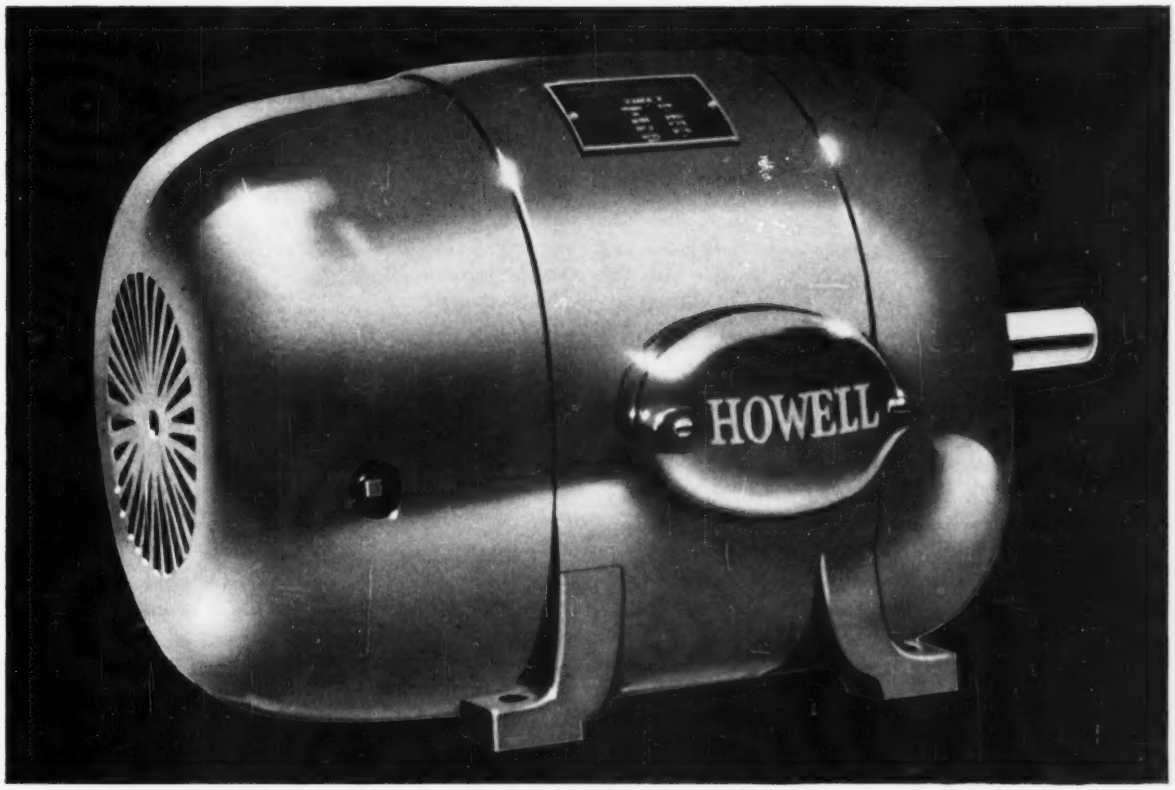
TAPS
Besly-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O. Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

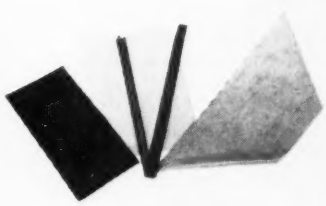
THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.

(*Continued on page 376*)



HOWELL FAN-COOLED MOTORS

Totally enclosed, protected against dust, fumes and moisture—the best looking motors your money can buy!



More and better insulation. Each slot cell has seven different pieces of insulation. Top and bottom coils and phase groups are insulated. Howell insulation is unsurpassed in quality.

Improved coil varnish. Type K stators are thoroughly impregnated twice with a phenolic, resin base varnish, and twice baked for unusual protection against moisture, dust, oil, weak acids and mild alkalies.

Howell Type K Motors outperform and outlast any open-type motor. Totally enclosed, all working parts are protected against the destructive action of dust, dirt, fumes and moisture. The fan-cooling prevents motor overheating.

The all-steel, streamlined housing conforms to the most modern trends in machine-tool design and factory layout.

Howell Type K Motors are available in all electrical types, from 1½ to 300 hp. at 1800 rpm., with vertical or horizontal mounting.

For more complete information on Howell's Type K Motors, contact the Howell man in your area, or write the factory for Bulletin K-2.

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

For more information on products advertised, use Inquiry Card, page 243

Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

THREAD MILLING MACHINES

Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
V & O Press Co., Div., Emhart Mfg. Co., Hudson, N. Y.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., Beloit, Wisc.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Lovejoy Tool Co., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Milholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 Wheeler St., Springfield, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Kennametal, Inc., Latrobe, Pa.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
OK Tool Co., Milford, N. H.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Metal Corp., Lexington, Ky.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Springfield, Vt.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland.

TUBE MILLS

Abbey-Etna Co., 2422 Maplewood Ave., Toledo 10, Ohio.

TUBING, Aluminum

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

TUBING, Brass and Copper

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

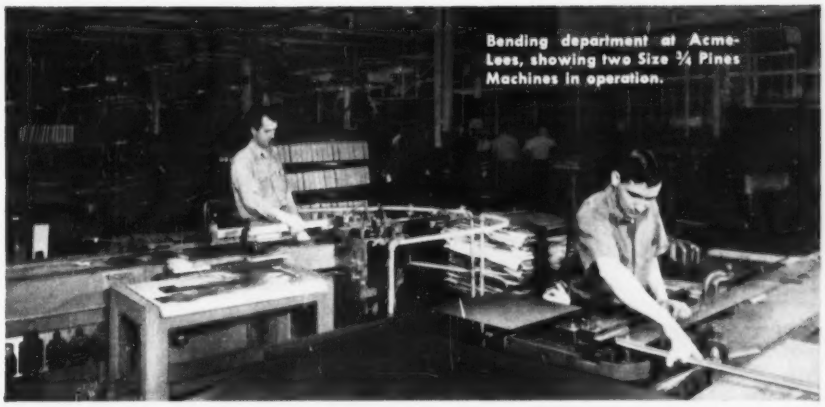
TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.

(*Continued on page 378*)

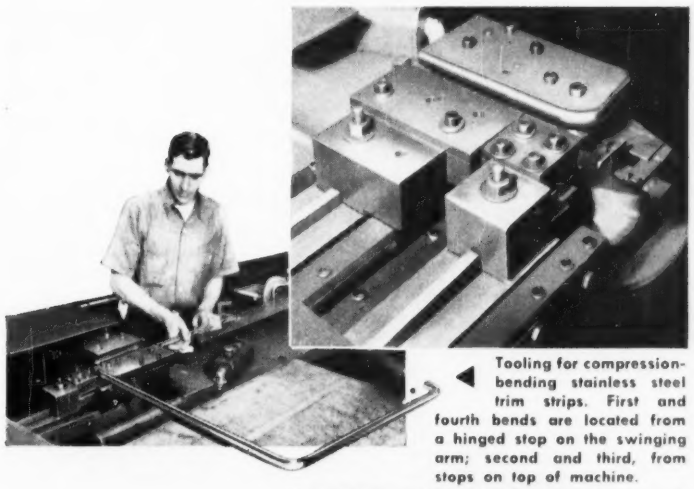
TRIM MOLDINGS PRODUCED 58% Faster

AT
ACME-LEES DIVISION
ON



Bending department at Acme-Lees, showing two Size ¾ Pines Machines in operation.

PINES SIZE 3/4 AUTOMATIC BENDERS



Tooling for compression-bending stainless steel trim strips. First and fourth bends are located from a hinged stop on the swinging arm; second and third, from stops on top of machine.

Tooling for draw-bending brass trim molding to 85° on a 1⅜" radius. Three different sizes of molding are handled with this same tooling by simply adjusting the distance between bends.

SKILLFUL TOOLING PRODUCES SMOOTH 1½" RADIUS BENDS IN .020" TYPE 430 STAINLESS STEEL

Here's a typical result story indicative of the bending skill of Acme-Lees Division, Muncie, Indiana, specialists in fabricating decorative trim moldings and extruded shapes for Appliance and Automotive Manufacturers. On a Size ¾ Pines Automatic Bender, .020" Type 430 stainless steel trim moldings are now formed with four unusually smooth 90° bends to a 1½" radius. Production speed is today 58% faster than by former manual bending methods. Current production is rated at 456 bends per hour as compared to 288 by manual methods.

HYDRAULIC ACTUATION REDUCES SCRAP LOSSES

As shown, the tooling is accurately machined to fit the shape of the delicate molding. A bronze wiper shoe eliminates marring the exterior finish. The operator simply positions the workpiece and starts the hydraulic clamping and bending cycle by push button. The uniform, dependable hydraulic stroke of the Pines Bender assures fast, accurate bends which reduce scrap losses and simplify assembly problems.

MAIL COUPON FOR Free DATA SHEETS

If you have bending work with tubing, pipe, bars, extruded or rolled shapes, write today for "Pines News"—illustrating bending applications, tooling, and cost-cutting production techniques.

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PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery · 687 WALNUT · AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS

See Drills, Twist

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

VALVE CONTROLS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Hannifin Corp., 1101 S. Kilburn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr. Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hendey Machine Co., Inc., Torrington, Conn.
Homestrand Inc., Larchmont, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VISES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, Lock

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WASHERS, Spring

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N.Y. (Stainless Steel only)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
General Electric Co., Schenectady, N. Y., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.

American Electric Fusion Corp., 2606 Diversey Ave., W. Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

WELDMENTS

Mahon, R. C., Co., Detroit 34, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

WIPERS

Scott Paper Co., Chester, Pa.

WIRE

American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Nilson A. H. Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Achry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

WORM DRIVES

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

WRENCHES

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Detachable Socket

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Keller Tool Co., Grand Haven, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

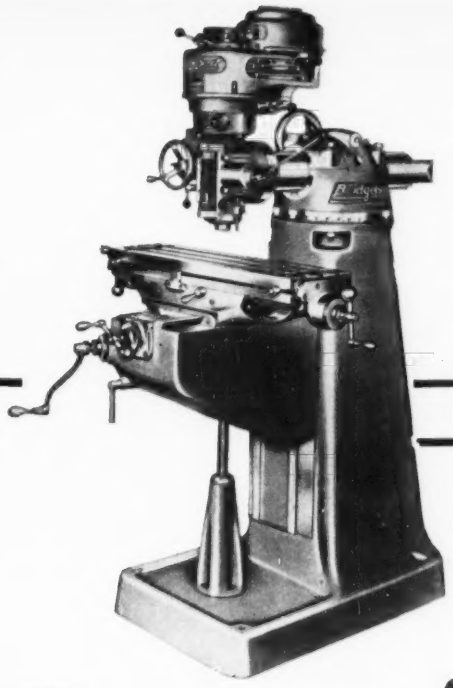
WRENCHES, Tap

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio

WRENCHES, Torque Measuring

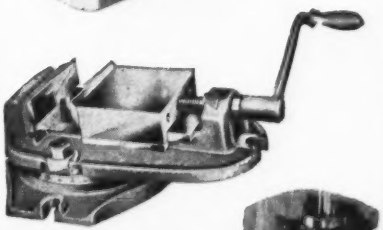
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Sturtevant, P. A., Co., Addison, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

The only way to meet 1954 production needs is on 1954 MACHINES.....



MILLING MACHINE VISE

This improved vise provides greater gripping power, is streamlined for appearance, has a large diameter screw for rigid holding and a coolant trough. Made in two sizes: 5" x 3½" and 6" x 5" jaw openings.



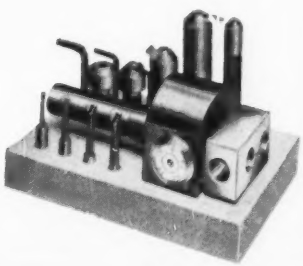
RIGHT ANGLE ATTACHMENTS

Left: Heavy Duty . . . for milling and drilling at right angles. Available for both Master and 1 HP Bridgeport Heads.

Right: Light Duty . . . for right angle milling and drilling narrow, deep molds and cavities.

No. 2 BORING HEAD

Boring Tools and Holder provide the means for boring holes up to 6" diameter. Available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.



Bridgeport

TURRET MILLING MACHINES provide for all TODAY'S REQUIREMENTS

Production problems of all kinds are being met and solved through the speed, low cost, accuracy and convenience of "BRIDGEPORTS". These machines offer the exclusive feature of being able to mill, drill, bore and shape, combined with ability to position the milling head at all angles over a wide area, *without changing set up.*

The year just passed has seen more than 2500 Bridgeport Milling Machines shipped to shops interested in making worthwhile improvements in their production. These shops appreciate the value of modernization made possible through the use of machines which in many respects are way ahead of their time in performance and end results . . . machines that are not only "1954 machine tools" but which will still be modern for many years to come.

Ask your dealer . . . or us . . . to show you how you can make the "BRIDGEPORT" a worthwhile investment for 1954 and for years ahead.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

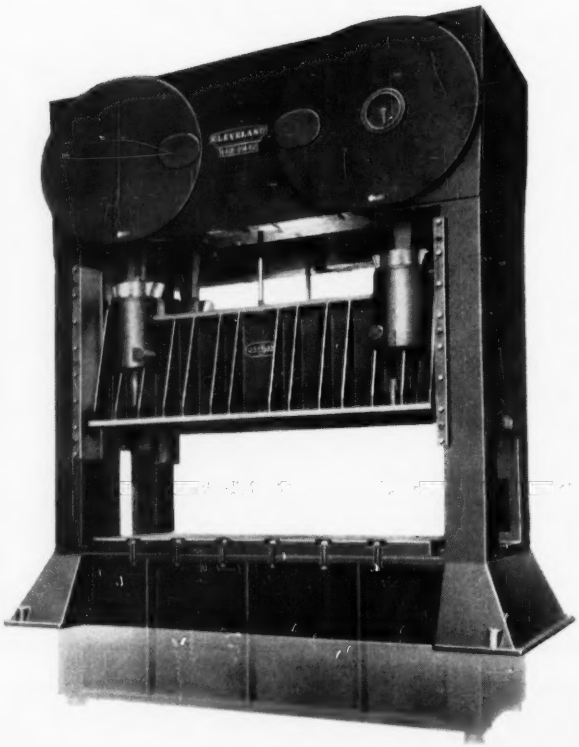
Presses are specialized too!

You'd be wasting time and energy if you tried to drive a spike with a tack hammer. It would be just as wasteful to use a giant Cleveland Four-Point Press to form a single, small stamping.

That's why we make 11 types of Cleveland Presses. Each type is available in a wide range of sizes and capacities.

If you're interested in stepping up production economy, let a Cleveland engineer study your particular needs. Follow his recommendations and you'll get the "right" press for utmost efficiency when you buy a Cleveland. Write or call today!

A-5511



CLEVELAND FOUR POINT PRESS 600-TON CAPACITY—40" stroke, 20" adjustment, 75" shut height, bed and slide area 102 x 204".

THE CLEVELAND PUNCH & SHEAR WORKS CO. U.S.A.

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY

CLEVELAND 14 • OHIO

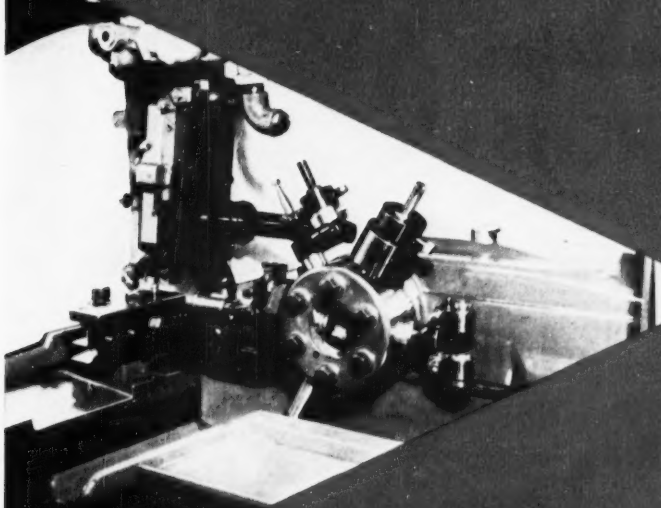
NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • E. LANSING

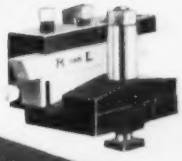
For more information on products advertised, use Inquiry Card, page 243

PRECISION IS AS PRECISION DOES

R AND L TOOLS

The Tools A Meticulous Machinist Would Design For Himself





Faultlessly ground for accuracy and alignment at any point of adjustment, here are tools of toughest, heat treated, alloy steel . . . guaranteed not to bend or give way. R AND L TOOLS were developed in a machine shop . . . the culmination of over 45 years of experience and research . . . truly masterpieces of the tool maker's art.

R AND L TOOLS pay for themselves through reduced setting up time . . . speeding up production . . . lower operating costs!

Write for Catalog

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET — PHILADELPHIA 40, PENNA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

Good judgment calls for

PARKER-KALON®

when good design calls for

SOCKET SCREWS

Your local P-K Socket Screw Distributor will provide any information you require for selection and specification...including the handy SOCKET SCREW DIMENSION FINDER (above) a pocket-size plastic slide chart. Ask for samples. Parker-Kalon Division, General American Transportation Corporation, 202 Varick Street, New York 14.

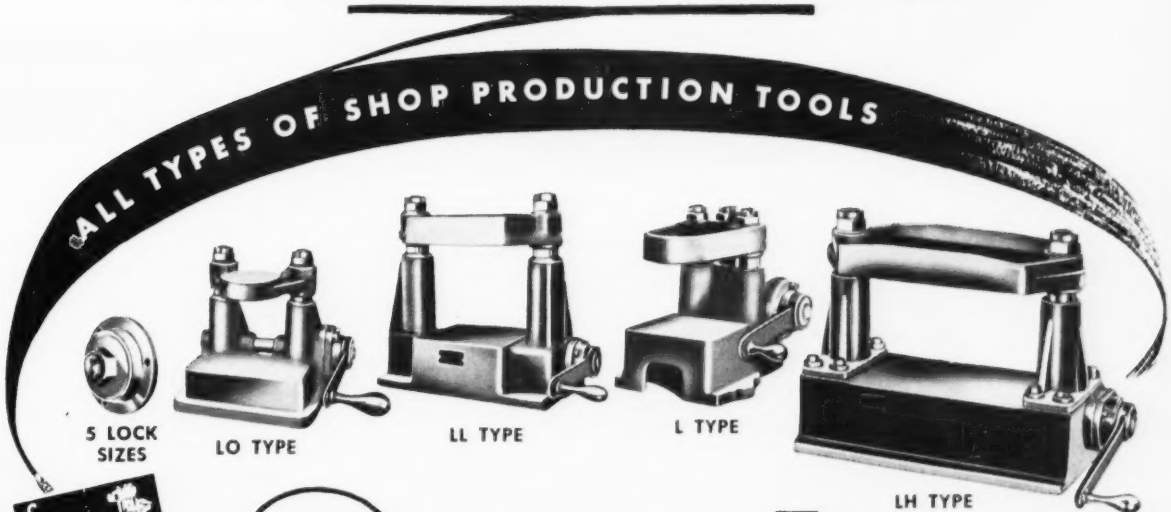
The INDUSTRIAL DISTRIBUTOR steers your Supply Dollars to the best values

For more information on products advertised, use Inquiry Card, page 243

Got a deadline to meet?

If you had a ***Swartz Standard Fixture***
in <u>your</u> shop your tooling problem
would be solved.

Swartz Fixtures *are usable on a multitude of jobs.*



WRITE FOR **NEW** CATALOG 953

MAKE USE OF OUR ENGINEERING SERVICE. AN AGENT WILL BE GLAD TO CALL.

There's a Swartz man near you

Swartz

TOOL PRODUCTS

DIVISION OF JEFFERSON CORPORATION

13330 FOLEY AVE. — DETROIT 27, MICH. TEL. WE 3-1522

now you have

the GREEN LIGHT

on faster production

more accurate work

better quality work

with these HORIZONTAL and VERTICAL

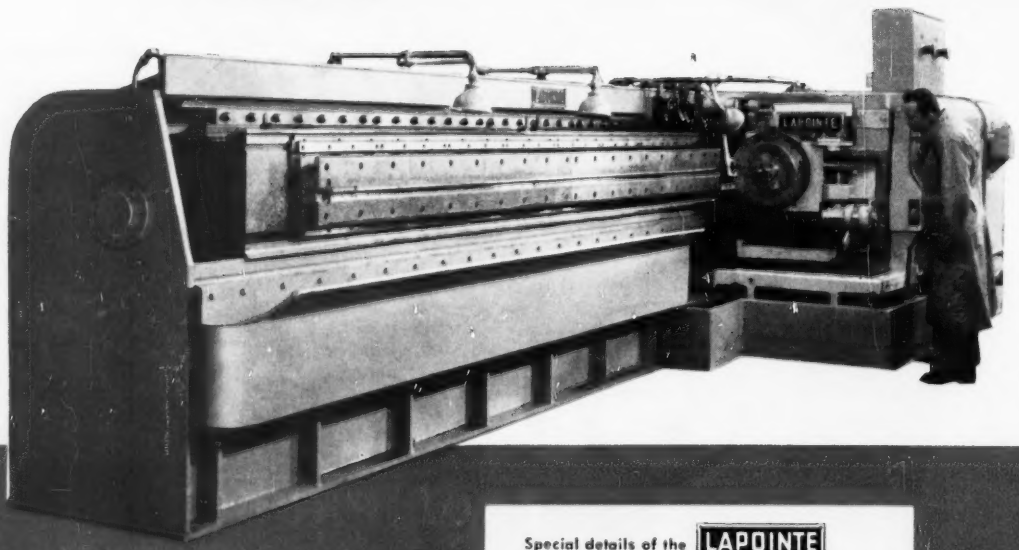
BROACHING MACHINES

BOTH EQUIPPED WITH

ELECTRO-MECHANICAL DRIVE

They represent the most advanced engineering in many years, in the field of BROACHING

BROACHING SPEEDS —



High Speed

LAPOINTE

Single Ram Horizontal
Electric Drive
BROACHING MACHINE

Special details of the LAPOINTE electric drive
HORIZONTAL BROACHING MACHINE

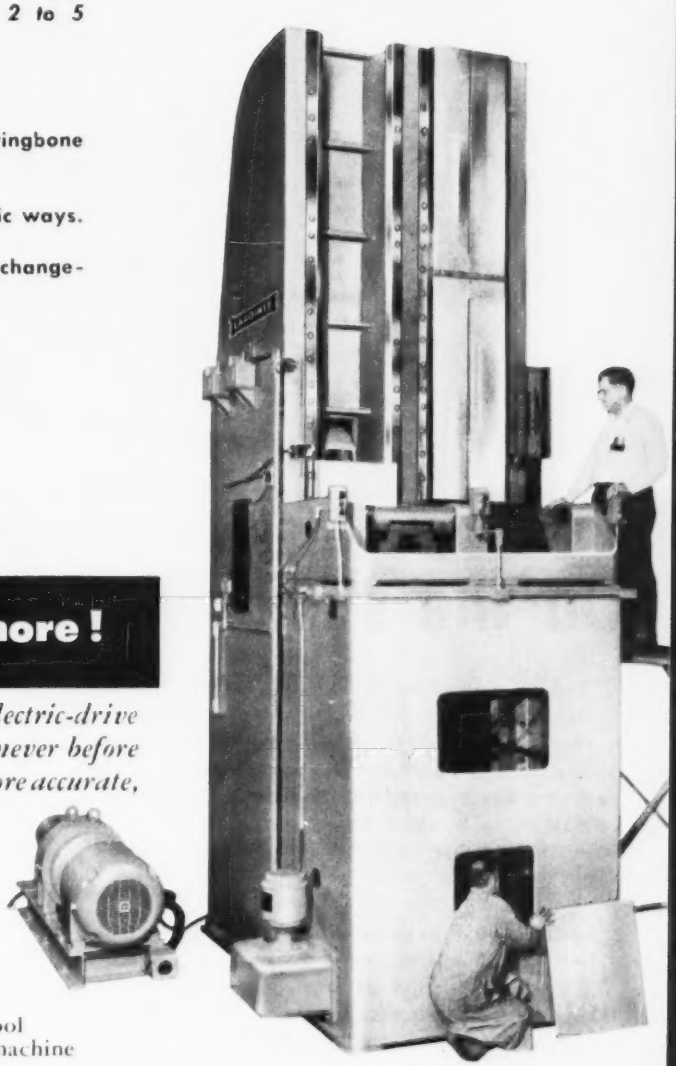
Optional: Dual Speed and Dual Cycle (Patented).
Two slide widths, 16" and 24".
Strokes up to 180".

Here are the outstanding features of *both* machines, horizontal and vertical:

1. Broaching speeds up to 300 feet-per-minute, *and more.*
2. Amazing smoothness of operation at high speeds.
3. Electro-mechanical drive.
4. Exceptionally heavy, rigid construction minimizes chatter and *increases tool life as much as 2 to 5 times!*
5. Variable speed at your fingertips.
6. Main driving gear is continuous-tooth herringbone type.
7. Massive main slide rides on natural phenolic ways.
8. Saves down-time caused by excessive tool change-overs.
9. Easy to load and unload.
10. Unusual versatility and flexibility.
11. Simplicity of maintenance.

Bulletins are available describing both these machines. Ask for "Electric Drive Bulletins No. 1".

(Photo taken during assembly)
Completely new LAPOINTE
Double Ram Vertical
Electric Drive
BROACHING MACHINE



— up to 300 fpm and more!

Yes, they're really fast! *What's more, these electric-drive machines give you a smoothness of operation never before attained in broaching. The natural result is more accurate, better quality work.*

Here's a thought: Don't judge a machine by **rated capacity** alone . . . judge it by its **output!**

A machine may be **rated** at so-many-parts per hour but what is its actual output per shift?

In other words, how much does **down-time** affect your total production?

That's where **tool life** comes in! By increasing your tool life as much as **200% to 500% between grinds** your machine is actually giving you **many more productive** hours by **saving the difference in down-time** represented by tool changeovers.

Special details of the LAPOINTE electric drive VERTICAL BROACHING MACHINE.
Double ram for high production. Slides are unusually heavy. Strokes available from 66" to 108".

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

NEW YORK HERALD TRIBUNE, MONDAY, AUGUST 24, 1953

Rebuilt Carrier Hornet Is Ready for Jet Age

By Jack Tait

The Navy aircraft carrier Hornet, toughened up to handle a brood of latest-type jet planes by twenty-seven months of exhaustive conversion at the New York Naval Shipyard, Brooklyn, will be recommissioned on Sept. 11, 178 years after the first Hornet, a sloop armed with ten nine-pounders, joined the then puny American navy.

Originally commissioned in 1943 and inactivated in September, 1946, the Hornet will be unveiled nexth month as a 1953 model which will cost the taxpayers one-third the price of a new carrier. Comdr. J. R. Newland, superintendent of the Hornet reconversion job, stood on the dock the other day and looked up at the Hornet and said, "she sure looks like a mess now, but we'll have her ready in fourteen working days."

"The Latest Thing Now"

"She's the latest thing in carriers now," Comdr. Newland said, "but Lord only knows how long she will stay that way. They keep coming up with new planes. They make the planes bigger and faster and heavier. Well, all we can do is to try to keep up with them."

Almost ready—Workmen on the flight deck of the carrier Hornet are busy completing the twenty-seven-month job of bringing the ten-year-old ship up to date. The hero of Pacific battles in World War II was decommissioned in 1946. When she is recommissioned at the New York Naval Shipyard, Brooklyn, on Sept. 11, she'll be tough enough to handle modern jet aircraft.

If the Navy will rebuild a carrier, it's logical to—

Do the same with your machine tools

Today's tough-to-machine alloys, carbide tooling, tighter tolerances and higher speeds put your machine tools in the class of a 1940 aircraft carrier.

Take a tip from the Navy. They saved time and the taxpayer's money by rebuilding the *Hornet* to jet age standards. If it can be done with a carrier, it can be done with your machine tools, no matter how large. You can save time and your stockholders' money by rebuilding your machine tools for today's tougher work.

Savings: 50% or more of the cost of a new tool. Delivery time: a matter of weeks.

Make a comprehensive study of your machine tools and their production records. Those that aren't performing as well as they should ought to be rebuilt. Draw up a list of these machines and send it to Simmons. We will promptly reply and, if necessary, send an engineer to make an on-the-spot study of the tools to be rebuilt. Quotations made on fixed price or hourly basis—whichever is the more appropriate.

And remember—all machine tools rebuilt by Simmons are unconditionally guaranteed. Write or phone today.

SIMMONS MACHINE TOOL CORPORATION
1600 North Broadway, Albany 1, New York
New York Office: 50 East 42nd Street

Engineered Rebuilding: a step-by-step process guaranteed to restore your machine tools to peak efficiency.*

- Machine tool completely dismantled — stripped down to bare castings and thoroughly cleaned.
- Machine is carefully studied to determine what must be done. Original manufacturer's specifications used as guide.
- All sliding surfaces checked for wear and refinished or replaced. (Ways, for example, can be replaced with new hardened steel ways, ground and hand-finished.)
- All bearings inspected and tested, replaced with new in slightest case of doubt.
- Modernized features added, as required.
- When replacements for worn parts cannot be purchased, we design, machine and heat treat with our own equipment.
- Entire unit is repainted and assembled.
- Machine tool is tested and inspected under actual operating conditions and shipped only if it meets performance standards set by original manufacturer.

* *. . . or modernize them for greater speed and capacity if you wish.*

SIMMONS
ENGINEERED
Rebuilding
GIVES MACHINE TOOLS A NEW LEASE ON LIFE

For more information on products advertised, use Inquiry Card, page 243

If WEAR *is a factor...*

...use

VK CARBIDE PLUG GAGES

TUNGSTEN CARBIDE
wire type .016″ to .500″ diameter

CHROME CARBIDE
taper insert type .500″ to 1.510″ diameter

In addition to its regular line of tungsten carbide wire type plug gages from .016″ to .500″ diameter, The Van Keuren Company now offers a new line of chrome carbide taper insert plug gages in the range from .500″ to 1.510″ diameter.

Van Keuren tungsten carbide wire type gages have proved their worth on thousands of tough gaging jobs. The new chrome carbide taper inserts (Carboloy, grade #608*) promise to be equally effective. Wearing qualities of chrome carbide are comparable with tungsten carbide. In addition, the material is lighter than tungsten carbide and has a coefficient of expansion close to that of steel . . . both of which factors are a distinct advantage in the larger sizes.

Finish on Van Keuren gages in either tungsten carbide or chrome carbide will average .5 RMS or better. These gages are available in Class Y, X and XX accuracies at moderate prices and on a reasonable delivery basis.

Send for a copy of the 220-page Van Keuren Catalog and Handbook No. 35 containing valuable technical and engineering information on measuring problems and methods. Address: The Van Keuren Co., 178 Waltham St., Watertown, Mass.

* Trademark of the Carboloy Dept. of General Electric Company.

VK

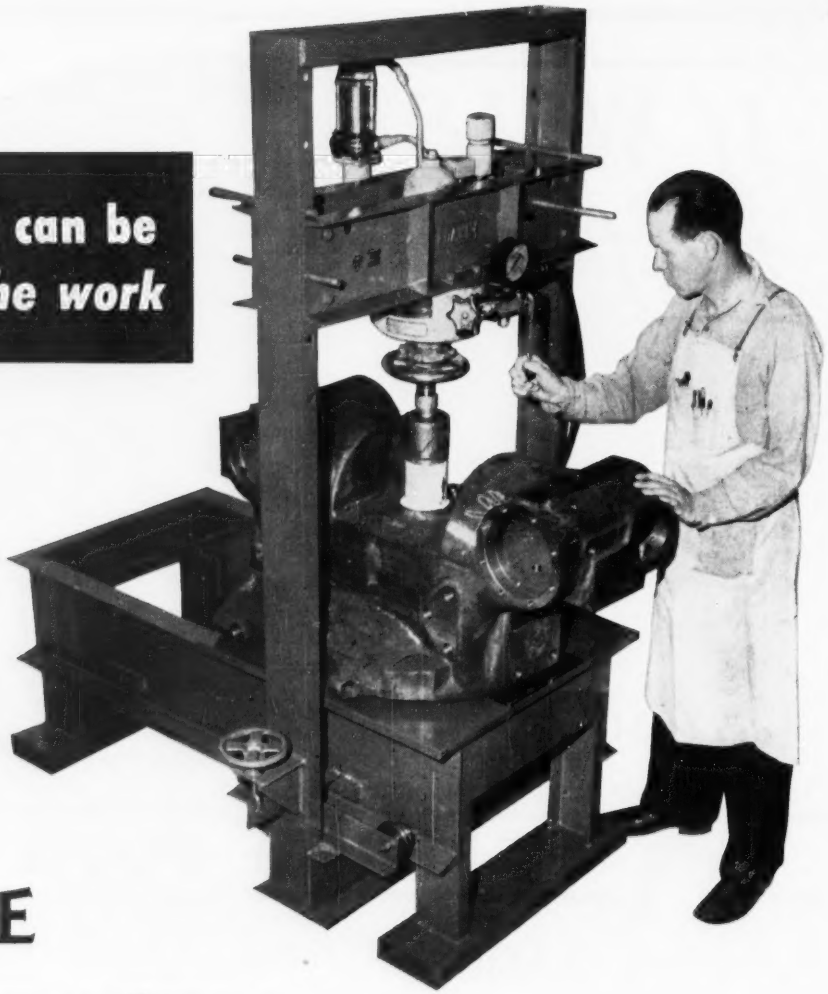
35th YEAR

THE *Van Keuren* CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages

THIS Press can be moved over the work



DAKE

Movable Frame Presses

make awkward, hard-to-handle jobs easy

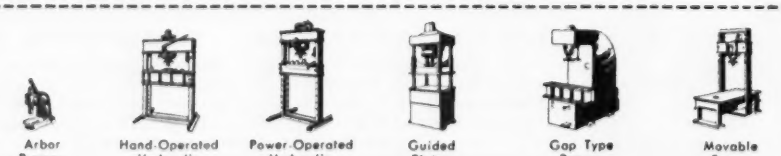
Here is the hydraulic press you need for work on awkward, heavy parts, and for handling large straightening jobs. Parts can be loaded on the work table with a hoist or fork truck—then the frame and workhead are centered over the job. The channels and workhead are easily raised or lowered if necessary to accommodate for work height.

DAKE Hydraulic Presses with movable frames are designed for hand, pneumatic, or electric operation. Capacities range from 25 to 300 tons. For detailed information, write for Bulletin 269.

In addition to conventional hand, air and electric hydraulic presses, Dake makes gap type, guided platen, and other special purpose presses.

Dake Engine Company, 604 Seventh St., Grand Haven, Mich.

DAKE PRESSES



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WHY YOU GET

Precision Flatness, Finish and Parallelity in Production Quantities . . .

WITH A LAPMASTER

Here is the machine to do the job if you want precision flatness in production quantities at an economical rate. Lapmaster machines readily lap to the extreme close tolerance of one light band (0000116") or less. In addition, they produce an extremely fine finish to as low as 1 RMS.

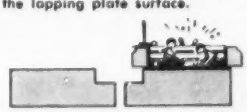
Check these features and investigate the possibilities for the Lapmaster in your plant.

1. Operator requires no previous lapping experience.
2. Automatic timer provides controlled lapping cycle for production efficiency and allows time for pre-loading workholders.
3. Simplicity of design allows ease of loading and unloading.
4. Loose abrasive distributed evenly over lapping area insures uniform results.
5. Serrated lap plate collects and disposes of spent compound and removed stock.
6. Precision laps identical parts or parts of various shapes, heights and materials in one cycle.
7. Self-conditioning lap plate eliminates down time for truing or replacement.

How the Lapmaster Works

The work being lapped causes wear on heavy cast iron lap plate.

As the work is wearing the lap, the conditioning rings are continually conditioning the lapping plate surface.



Since the wear action of the conditioning rings is greater than the wear caused by the work being lapped, the flatness of the lap plate is automatically maintained.

FREE DATA

Learn more about the possibilities of production lapping and the interesting subject of measuring flatness. The illustrated fact-filled booklets are yours for the asking. Write today.

Crane Packing Company, Dept. M-10, 1833 Cuyler Avenue, Chicago 13, Illinois

JOHN CRANE

CRANE PACKING COMPANY

"We Trim Castings 4 Times Faster" with MULTIPRESS®

—and get uniformly better results, reports The Hoover Co., North Canton, Ohio, world's largest manufacturer of electric cleaners for home use!

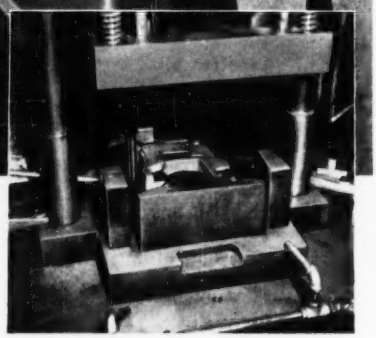
Using a 25-ton Multipress to trim large cast-aluminum housings for the famous Hoover Electric Cleaners, one man averages more units per hour than four men could handle by the old method.

The smooth hydraulic stroke of the Multipress ram does the job better, Hoover reports. Uniform accuracy is maintained automatically. Down-time resulting from damaged dies is held to near-zero. And because Multipress trims the castings *inside and out* in one fast, easy, precision operation, damage from rough, multiple handling has been sharply reduced.

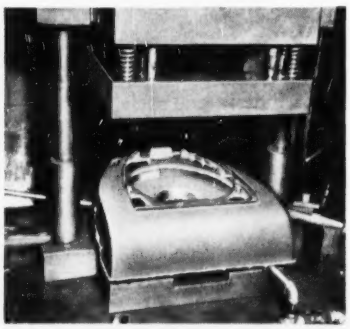
Other Multipress advantages listed by Hoover include fewer rejects or throw-outs, greater safety for the operator, lower tool and die costs, quicker, easier tool change-over, and major savings in floor space for all trimming operations.

Hoover is now using 14 Multipresses of one-ton, 4-ton, and 25-ton capacities. In addition to manufacturing electric irons, washing machines, floor polishers, and electric motors, Hoover produces die castings for other leading manufacturers.

Above: 25-TON Multipress in operation at Hoover plant in North Canton, Ohio



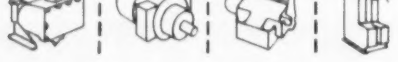
Above: Close-up of Multipress Tooling
Below: Casting in place, ready to trim



Multipress is bringing production gains like these to hundreds of manufacturers. Advanced valving and controls give Multipress smooth oil-hydraulic action plus quick, easy, stepless adjustments in ram speed, stroke length, and pressure. A wide choice of manual or automatic controls covers any need for single or sequence operations. Automatic feeds and other auxiliary Multipress equipment provide extra speed and efficiency on many types of operations. Multipress is built in nine frame sizes, with pressure capacities from one to 75 tons.

DENISON Hydr OIL ics

PUMPS | MOTORS | CONTROLS | PRESSES



Write for complete information on the Denison Multipress. . . there's no obligation!

THE DENISON ENGINEERING CO., 1152 Dublin Rd., COLUMBUS 16, OHIO

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MADISON-KIPP *Fresh Oil*

. . . FED UNDER PRESSURE BY THE MEASURED DROP

the most dependable method of lubrication ever developed!

This lubricator becomes an integral part of a machine tool in which there are 48 vital bearings that require dependable lubrication. The Madison-Kipp mechanism is so compact that the reservoir measurements are only 4" wide, 19¾" long by 5¾ high."

There are six different models to meet almost every application requirement. Please write us for all details regarding your particular lubricator requirements.

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WISCONSIN

kipp

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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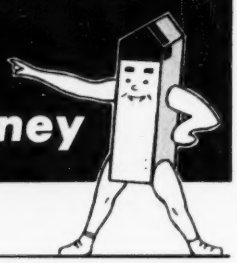
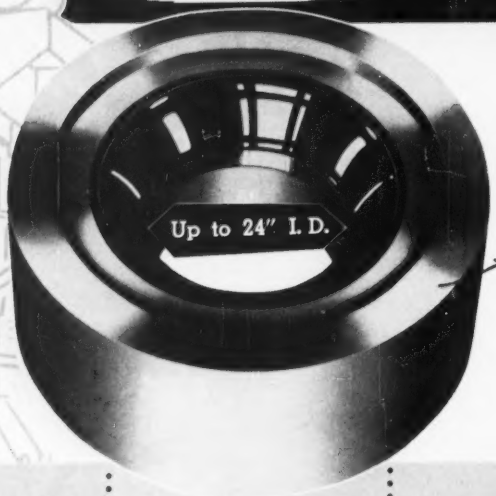
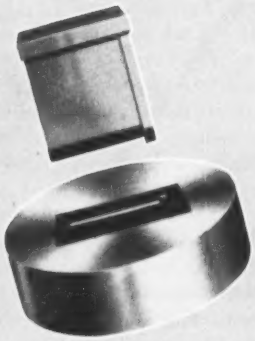
Production Records Prove *Talide Dies* Save You Money





● 137,000 hi-alloy steel Pressure Vessels deep drawn through a TALIDE Sheet Metal Die—with buffing and polishing costs cut 80%—downtime 98%—and scrap 100%. Best production from steel die used previously was 7,900 cylinders before wearing oversize.



BLANKING AND FORMING DIES

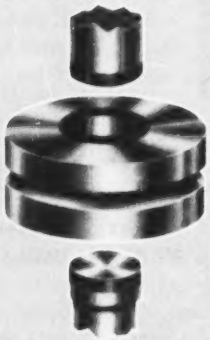
Over 5,000,000 abrasive paper discs blanked out with a TALIDE Blanking Die—70 times more than produced with hard alloy dies used previously.

HEADING AND EXTRUSION DIES

Costly cold-heading job on 3/4" carriage bolts producing only 50,000 pcs. per steel die made profitable with average 1,500,000 piece production runs with TALIDE Cold-Heading Dies.

CURLING ROLLERS

Large Can Company reports TALIDE Curling Rolls last 65 times longer than steel rolls on beverage can forming operation—with edges free from burrs and cracks.



POWDER METALLURGY DIES

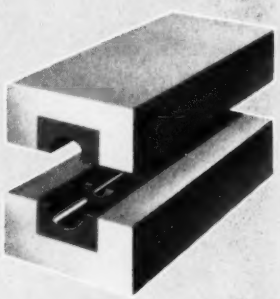
Large Pharmaceutical Company reports TALIDE Pill Dies not only produce tablets having a superior surface glaze which reduces rejects 82%—but also outlasts steel dies 100 to 1.

TUBE MANDRELS

12 days (36 shifts) of continuous trouble-free production obtained by eastern Brass Mill with TALIDE Tube Drawing Mandrels—compared to average 8-hr. runs obtained with steel mandrels.

DRAWING DIES

50 miles of tough 5" alloy steel tubing (actually 252,000 ft.) drawn by large midwestern Steel Mill through TALIDE Tube Die compared with a normal run of 10,000 ft. with a steel die.



SWAGING DIES

Leading Fountain Pen Manufacturer cold swages an average of 750,000 stainless steel sleeves with TALIDE Swaging Dies — 33 times more than with chrome-plated dies.

● Available in size range from .010 to 24" I.D. and in any shape, Talide Dies meet every requirement. Uniform quality and consistent performance are assured by 21 grueling tests including physical, chemical and metallographic. Send us prints or parts of your particular die application for estimate and recommendations. **Metal Carbides Corp., Youngstown 7, Ohio.**

Send for new 84-page Catalog 54-G or ask for sales engineer to call.

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BRASS TUBE EXTRUDER

This 2300 ton W-S Extruder was recently designed and manufactured for the American Brass Company, Waterbury, Connecticut.

Now for the first time, all the advantages of direct drive and automatic cycle have been incorporated in an oil hydraulic piercing type extruder . . . without sacrificing speed or cycle time.

This press, designed for the copper and brass industries, has a maximum billet length of 27" and will extrude 60 billets per hour. Press, without runout table, measures 56' long, 12'6" high and 17'9" wide. Total weight is approximately 480,000 lbs.

Let us acquaint you with the complete line of W-S extruders . . . and the advantages of direct drive design.

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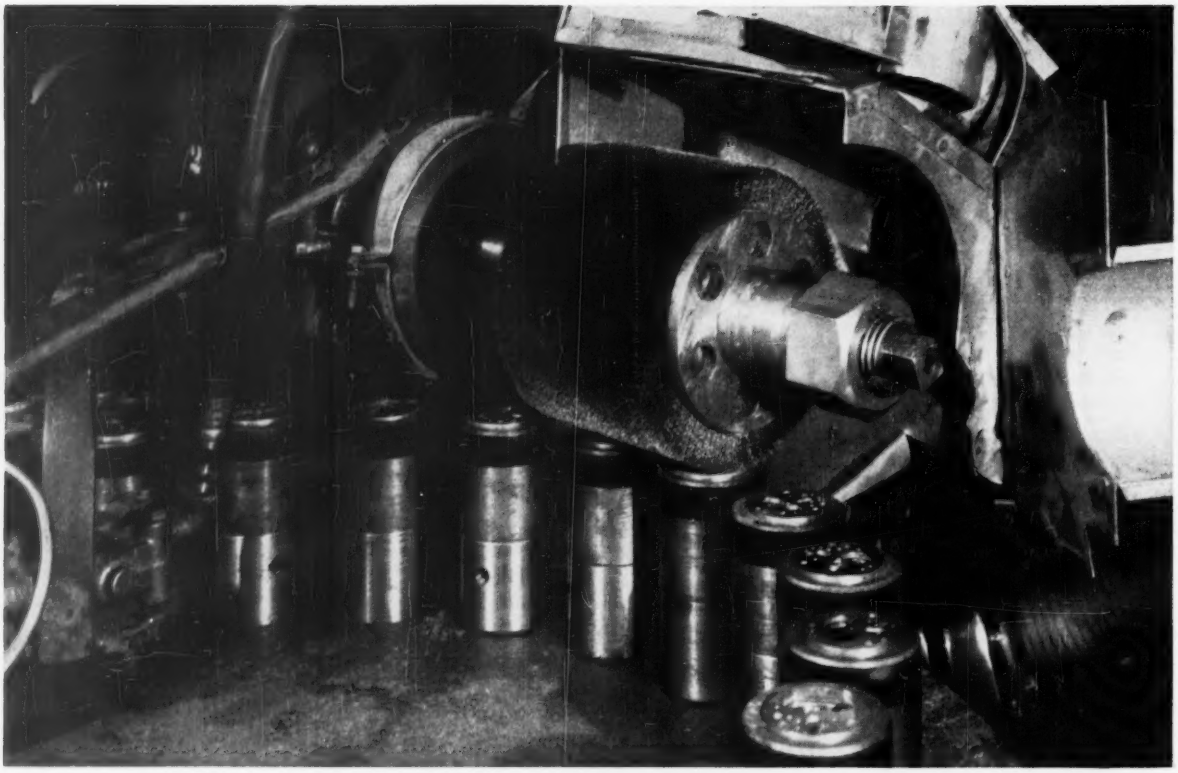


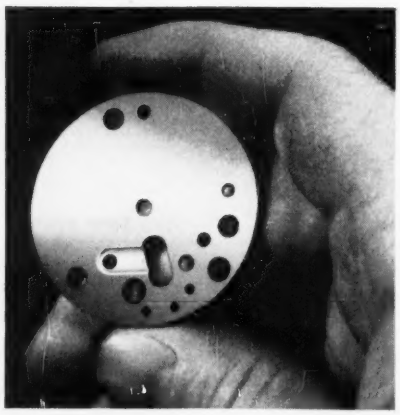
How to brush down finishing costs *automatically*

Power Brushing finishes both sides of these brass discs at a rate of 15,000 per machine per eight-hour day. It does a better, more uniform job many times faster than hand methods.

Parts are placed on spindles which rotate at 60 r.p.m. The table also turns at about one revolution in 25 seconds bringing the Osborn Economy Section Brushes into contact with each part in turn. Spindles stop rotating as they approach the loading station, where a mechanism lifts finished parts and air pressure blows them into a chute.

A similar automatic operation with Osborn Power Brushing may improve the quality and speed of *your* cleaning, finishing and deburring operations . . . whether you process large parts or small . . . made of metallic or non-metallic materials. Ask your nearby **O**sborn **B**rushing **A**nalyst to appraise *your* possibilities. Write to *The Osborn Manufacturing Company, Dept. D-14, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

FREE: New booklet on deburring with Osborn Power Brushing. Ask for your copy.



The finished part. Osborn Power Brushing removes feather burrs and blends surface junctures.

Osborn Brushes

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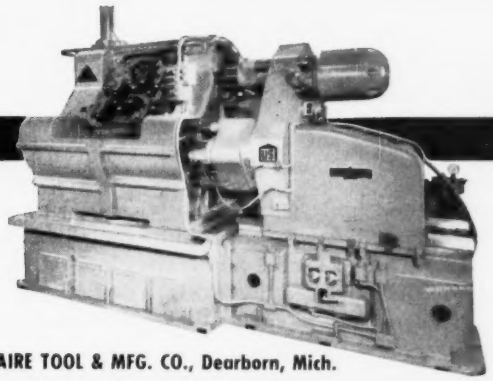
THESE MACHINE TOOL BUILDERS RELY EXCLUSIVELY ON US INDIVIDUAL LEAD SCREW TAPPERS WITH SHAVED GEARS AND THE PATENTED *SAFETY TAP HOLDER*

Only with the U. S. ***Safety Tap Holder*** are the spindles automatically re-set for continuous machine cycling during the prevention of tap breakage due to bottom tapping, dull taps or holes not drilled.

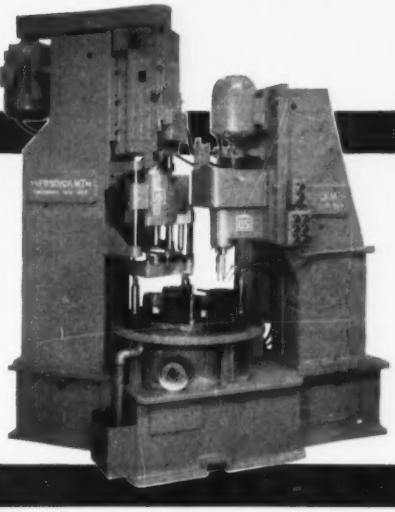
AVEY DRILLING MACHINE CO., Covington, Ky.

This complete tapping machine has provisions for a fifth U. S. Head to be added at a later date. All lead screw tappers are equipped with shaved gears and the U. S. patented ***Safety Tap Holders.***



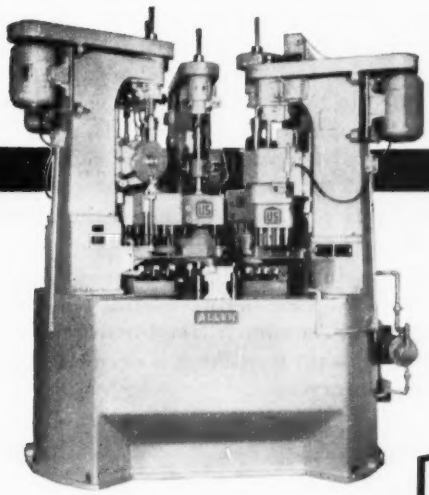
LEMAIRE TOOL & MFG. CO., Dearborn, Mich.

This machine drills, reams, chamfers and taps holes in a crank shaft for a farm tractor engine using a U. S. combination head, having individual lead screws with the U. S. ***Safety Tap Holder*** at the tapping station.



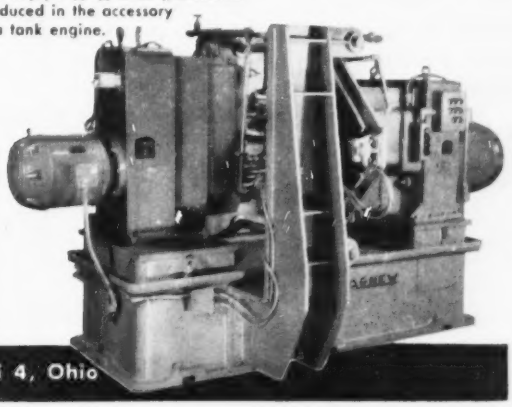
FOSDICK MACHINE TOOL CO., Cincinnati, Ohio

Combination drill and tapping machine still in use after many years, at an automotive accessory plant. Operation performed on a motor sheave.



AGNEW ELECTRIC CO., Milford, Mich.

A complete tapping machine having a total of 76 spindles. One 38 spindle, one 20 spindle and one 18 spindle U. S. individual lead screw tapper. Straight threads ¼-20 to ½-13 and tapered pipe ⅛-¾ class #3 thread were produced in the accessory case of a tank engine.



CHARLES G. ALLEN CO., Barre, Mass.

This machine has operated 16 hours per day since 1950, performing a bottom tapping operation in every cycle without a replacement part required on any portion of the lead screw spindle.

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U. S. DRILL HEAD CO., 616-618 Burns St., Cincinnati 4, Ohio

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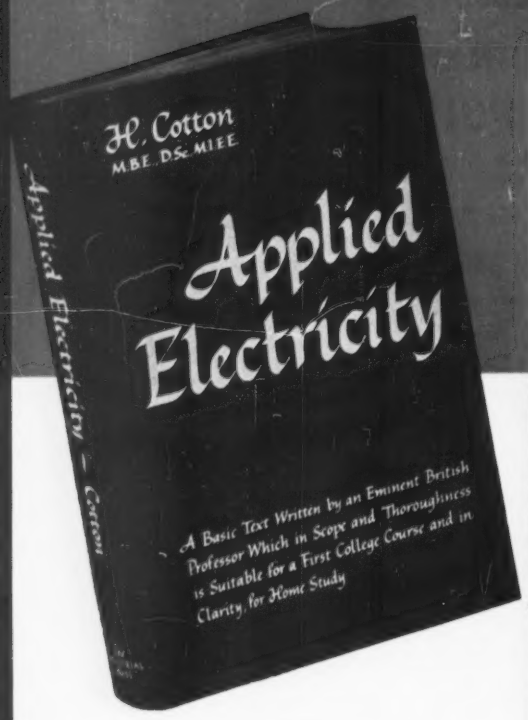
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THE close tolerances specified by the aircraft industry are a challenge to the "world's most modern milling cutters" and the "world's most modern milling machines."

The picture shows one of thousands of milling machine operations. Note the tilting fixture which makes possible face and periphery milling of both sides of the cylinder head.

OK carbide milling cutters are widely used in the aircraft industry because they have the necessary stamina . . . *more beef* in the body, pack *more blades* for finishing cuts, *heavier blades* for *roughing* cuts. They put more finished pieces on the floor, day after day.

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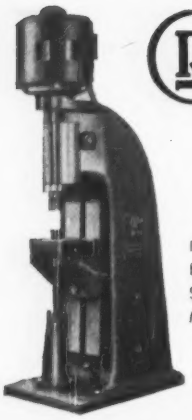
modern milling cutters *for* **modern milling machines**

THE OK TOOL COMPANY, INC. Milford 6, New Hampshire



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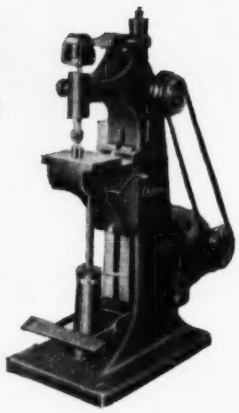

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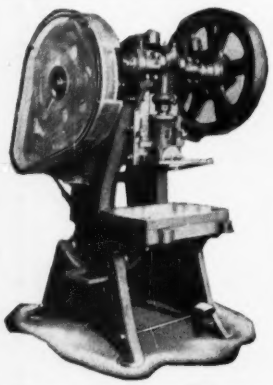

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Positive ¾" ram adjustment.

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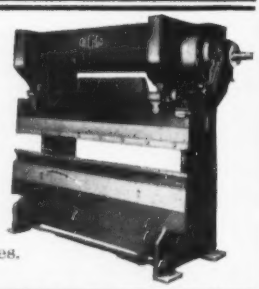

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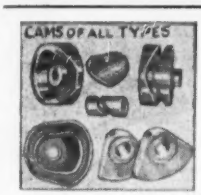

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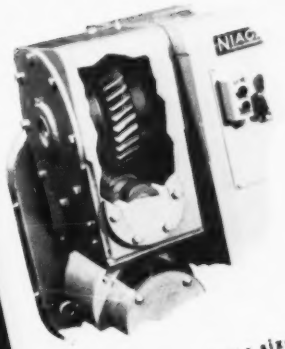

Drawing above shows size 200 Cleveland worm gearing which drives bending roll backwards or forwards or by short jogs as operator wishes.

Illustration courtesy of Niagara Machine & Tool Works.

CLEVELAND worm gearing drives Niagara bending roll

FINGER-TIP controls on this new 6″ Bending Roll reverse direction of steel sheets or plates instantly. But sudden stopping, starting and reversing is bad for ordinary gearing. That's why Niagara uses Cleveland size 200 heavy-duty worm gearing for its new series of modern bending rolls.

Worm gearing as engineered by Cleveland is designed especially for this kind of punishing service. Case-hardened steel worm, meshing on long-wearing nickel-bronze gear, is made by master craftsmen to last the life of any driven machine. The compact, right-angle drive takes up little space, permits streamlined design of the machine. And it provides the high reduction ratio of 50: 1!

These are a few of the reasons why machine builders and users standardize on Clevelands when they want powerful drives to operate dependably under all conditions.

Get the facts on Clevelands. Write today for new Catalog 400. The Cleveland Worm and Gear Company, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

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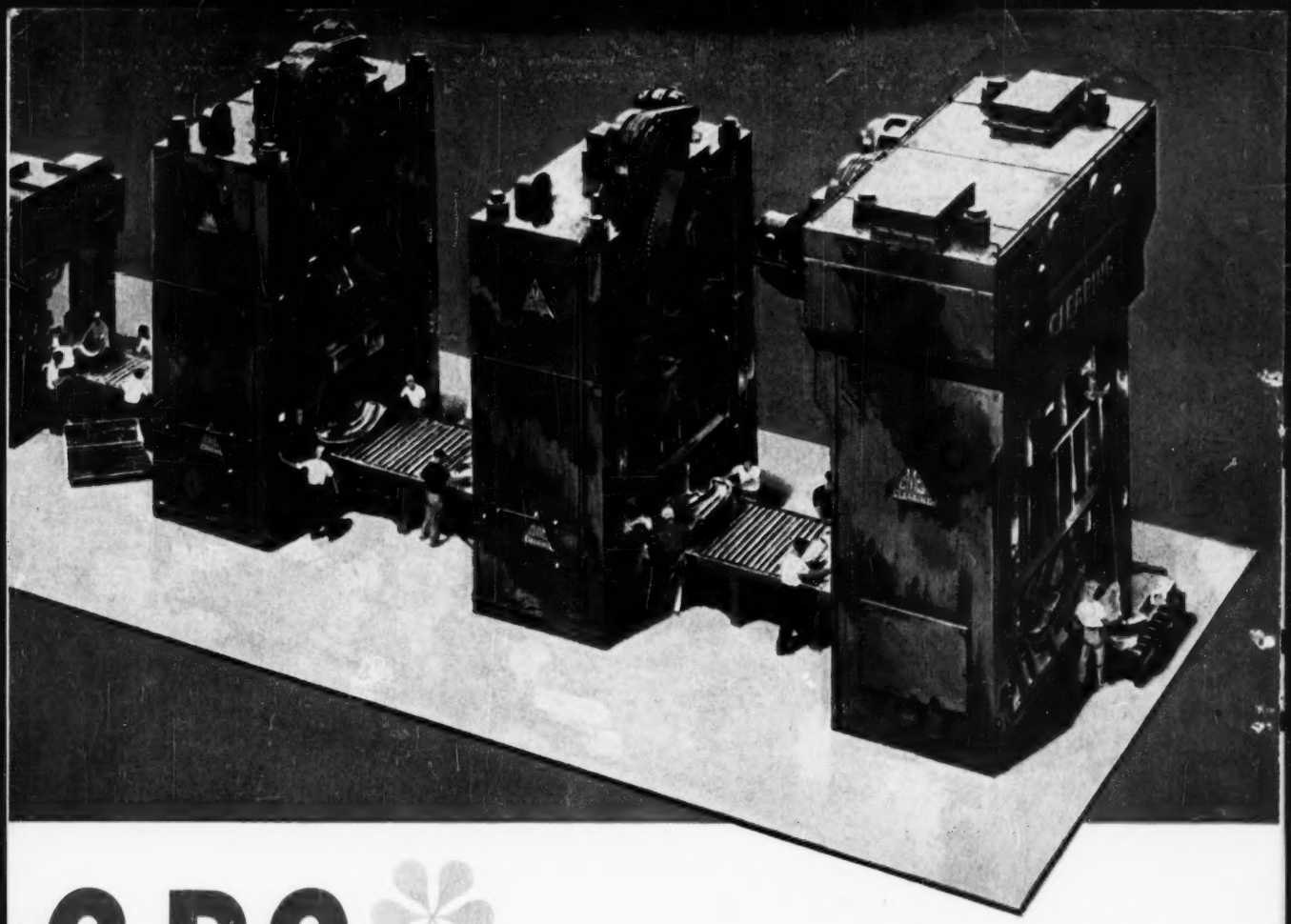

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